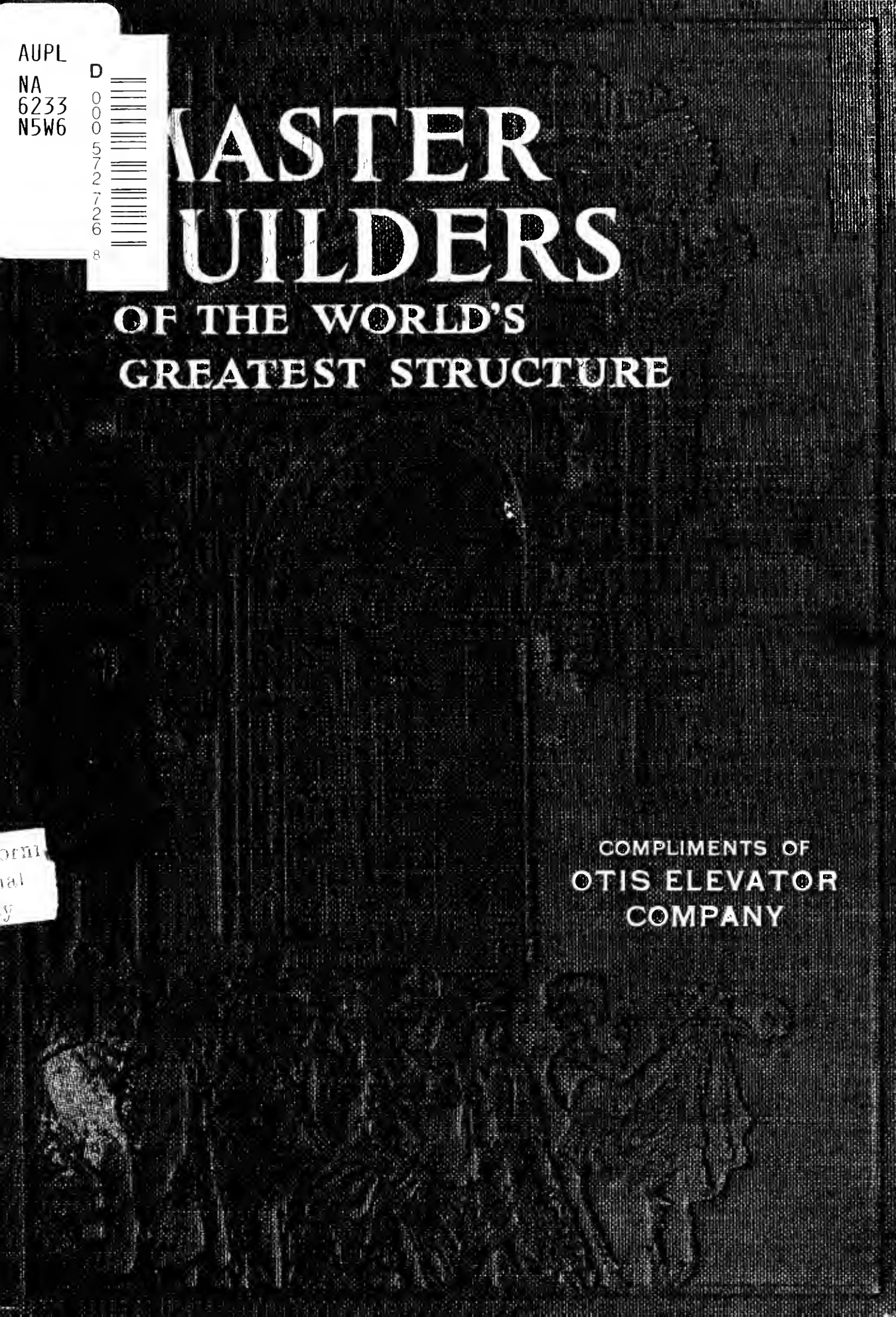
MASTER BUILDERS

OF THE WORLD'S GREATEST STRUCTURE



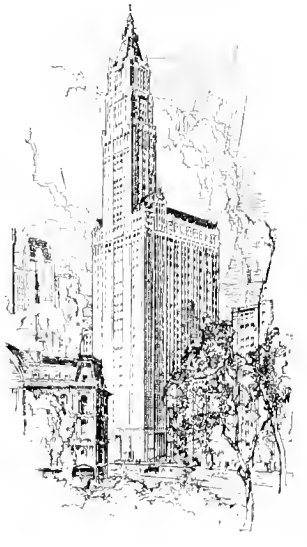
COMPLIMENTS OF
OTIS ELEVATOR
COMPANY

WOOLWORTH BUILDING

THE EVER CHANGING SKY-LINE OF NEW YORK

THE MASTER BUILDERS

A RECORD OF THE CONSTRUCTION OF THE WORLD'S HIGHEST COMMERCIAL STRUCTURE



PUBLISHED BY
HUGH McATAMNEY & COMPANY
NEW YORK
1913

MUNDER-THOMSEN PRESS
Baltimore and New York

FOREWORD

THE master builders who builded the awe-inspiring cathedrals of the Middle Ages gave expression to a deep and rich communal spirit. Closely knit in interests and united by a common love for the beautiful, they co-operated to embody in stone the noblest thought and aspirations of their time.

To-day we are deemed incapable of this kind of fruitful co-operation. Critics have often said that the commercialism of our age stands in the way of a group of men who would bend their best efforts to the production of a beautiful object by their common labor. That this indictment is unjust one has but to know the extraordinary services rendered by all the contractors and builders who aided in the erection of the Woolworth Building.

From the time that the first spade of earth was turned to the last touch on the topmost spire of the tower every one of the hundreds of men, from chief executive to day laborer, worked harmoniously and in unison like a well-trained army of veterans. The man of theory and the man of practice, the man who worked with his brains and the man who worked with his hands, all united to translate the thing that was on paper into the concrete handiwork of the master builders.

But what seemed most remarkable to the layman as well as to the experienced architect and builder was the intelligent manner in which the individual contractor approached his appointed task. Each contractor came to the work with a clear conception of his special duty and a realization of his own responsibility. Each contractor worked as a unit in co-operation with the other contractors, and all together they formed a working organization that was responsible for the completion of the greatest structure in the world in record time and without serious delay or mishap.

Of course, such splendid preparedness bespoke a well systematized organization that could measure up to an unusual emergency. But it was this very fact that determined the selection of a contractor for work on the Woolworth Building. He not only had to be the best in his field, have the best material at his disposal, the best talent at his service, but it was also essential that he have an organization back of him which was thoroughly adequate and had reached the maximum of efficiency.

Personally I believe that the contractors and workers who aided in the completion of the Woolworth Building are rightfully proud of their part in the work, not merely because of the magnitude of the undertaking but also because of the exacting conditions that were demanded of them. But in quality of work and material, in speed and resourcefulness, each contractor fulfilled all conditions, thus giving him the rightful title of "Master Builder."

Frank W. Woolworth

MR. WOOLWORTH

WOOLWORTH BUILDING

THE ARCHITECT'S APPROBATION

THE building of to-day is a complicated organism such as has probably never existed in any preceding age. The materials are gathered together from all over the world, they include iron, copper, lead, tin, zinc, nickel, silver, and gold; stone brought from quarries hundreds of miles away; marble mined on the slopes of the Alps in Northern Italy, in the snowy hills of Vermont, or in the sunny isles of the Greek Archipelago are wrought into these structures; asphaltum from South America, pitch and tar from our native forests; foreign-made cements and cement in vast quantities from our own country; oil from far-away China; oak from England; mahogany from the islands of the Caribbean Sea; walnut from the Circassian Mountains; glass from the borders of the Ohio and from the factories of Bohemia and Venice; in short, from almost countless sources are these materials brought together and assembled. Skilled workmen from all lands are required for the shaping or manufacture of these materials. Modelers, carvers, smiths, diggers, woodworkers, metallurgists, weavers, plasterers, mosaic workers, painters, gilders, coppersmiths, plumbers, electricians, machinists, masons, riggers, and many other artists and artisans contribute, each in their own way, to the preparation of materials and their erection in place. Thousands of drawings must be prepared for such a work not only by the architect and his staff, but by most of the arts and trades employed. Skill and organization to the highest degree is absolutely essential, and, more than this, both moral and physical courage are necessary to success— moral courage on the part of owners, architects, engineers and contractors in the willingness to undertake so large an enterprise and to persist in the effort until completion, and physical courage, compared with which the courage of the soldier under fire is not more heroic; for in the mine and quarry, in the excavation and the caisson, in the hazardous height to be scaled by the workmen erecting the structural steel, terra cotta, and the roofing, or trades associated with them, lurk imminent and terrible physical dangers every hour of every day, and such work is quoted as "extra hazardous," for so it is in every sense of the word. Out of this common effort arises a common interest and the men engaged therein are linked by ties, the strength of which they themselves do not realize.

The recognition of this common interest by employer and employed alike is the best guarantee of future joint effort, for it is only by the combination of the interests of capital and labor that organized society can successfully exist. The building which we have been engaged upon can well be said to symbolize this unity of effort and of interest of all who have had a part in its creation. This building will house thousands of tenants and within its walls will be transacted business of vast extent and importance. The wise liberality of the owner provided that the structure should be enriched and

MR. GILBERT

beautified so as to give pleasure to the millions of people who will see it. His effort therefore was not alone to make it a purely commercial structure but to clothe it with beauty and to make it a worthy ornament to the great city of New York. Others must judge how far this purpose has been achieved. He has fulfilled the eloquent invocation of Daniel Webster, who said: "Let us develop the resources of our land, call forth its powers, build up its institutions, promote all its great interests, and see whether we also, in our day and generation, may not perform something worthy to be remembered." We may all have a just pride in having contributed to this endeavor.

I take this occasion to congratulate the contractors, sub-contractors, and all those who have furnished material or labor upon the completion of the work in which we have been engaged, and to thank them all for the spirit of co-operation which pervaded the work from the beginning. I hope that this expression of appreciation will be conveyed to the artists, the designers, the artisans, the workmen, and the laborers as well as to those who assumed the responsibility of contract obligations, for, speaking broadly, I believe that each has fulfilled his duty as he saw it and has contributed in proportion to his ability and his opportunity.

LOUIS J. HOROWITZ, PRESIDENT, THOMPSON STARRETT COMPANY, GENERAL CONTRACTORS

THE MASTER BUILDERS

of the

Highest Building in the World

THE United States of America has set the pace for building construction of the entire civilized world. In the first place the architects are of the highest type—cultured men who are devoted to their profession, because its scope is almost unlimited in its possibilities, and its rewards are great.

The American architect must not only be an artist in designing beautiful and useful buildings, but he must have sound knowledge of every detail of building construction, from the foundation to the pinnacle which rears its head into the clouds.

This is a practical age, and fortunately the Master Builders are selected in the light of intelligence and knowledge. The fame of their work has gone before them. The quality of their products and appliances is well known to the architect and the great contractors who harmonize with him in the realization of his plans and designs, and the grand result is that, day by day and step by step, the million details of the building, great or small, are arranged in mathematical order and the work is satisfactorily completed in the time specified in the contract, while the owners, contractors and architect are satisfied.

These conditions are possible only when each individual Master Builder is a man of special knowledge and skill in his line and of high character, who employs only skilled artisans of the best class. Such men seek to work in harmony with the hundred or more other Master Builders, and use their best endeavors to not only live up to the specifications of their particular contract but to excel in excellence of work wherever possible. With some Master Builders reputation is a far greater consideration than profit or loss. Naturally they look into the future and expect to have their material or appliances or work named in other specifications, and their aim is not only to pass the scrutinizing examination of the superintendent, but to earn just praise and recommendation.

It may be asked why New York City attracts the best class of Master Builders—men who are specialists in their particular line of business, whether it be excavating, brickwork, machinery, steel construction, plastering, or any other branch of building construction. The answer is—the appreciation of excellence in the work and better reward than can be had in any other part of the world. "Honor to whom honor is due" is not yet worn out as a saying, and this small tribute to the Master Builders of the world's highest building

construction is an endeavor to place the wreath of merit where it is well deserved.

The Master Builder who has had a part in the building of the beautiful Woolworth edifice may mark down the fact in his diary as an epoch in his life. There may never be a building erected in New York City which will tower away so high skyward. Land is too precious and high buildings must have wonderfully strong and great foundations. Another note he may make in his diary is that he will never see a more beautiful building in New York or any other city. Its beauty is truly emphasized at the present time (September, 1913) by comparison with the plain block of the old Astor House now being demolished. It may be looked at from all points of view, and comparisons made with even the newest office buildings around the city, and the artistic eye will look again at the beautiful and lasting decorations of the facades and the tower of this majestic palace of commerce with refreshing joy.

THE EVOLUTION OF OFFICE-BUILDING

The Advent of the Elevator

THE STEEL SKELETON

IT is some years since the wealthy men of New York or any other important city of the United States were satisfied with a three-story, brick-front building, trimmed with sills and crowned with Grecian cornices of painted wood. In these days of swift elevators and steel framework the three-story edifice is only to be found far out in the suburbs, or on mountain sides. The "Herald" office is a marble exception to the overwhelming evidence in New York in favor of the giant building construction. True, there are other one-, two- or three-story buildings scattered about, but they are only awaiting their turn to fall into the wrecker's hands.

The rapid development of New York City during the past half-century is almost inconceivable, and land has become so precious - especially down-town in the radius of the City Hall, the Post-Office, the Treasury, the Clearing House and the Stock Exchange—that in order to make room for the business population, lofty buildings have become an absolute necessity.

When elevators and steel or iron girders and frames were only architectural dreams, owners of land could find no way to erect buildings which would yield a profitable rent. Rock foundations were not sought by boring to any great depth in those days, and very thick and costly walls were built to support even five- and six-story buildings. But when these were built, tenants would not climb more than one or two flights of stairs and pay a fair rental.

But in 1859 the elevator was patented, and after some years of experimenting it was adopted in the first Equitable Building, at 120 Broadway, in 1870. Real estate men laughed at the innovation and prophesied empty offices above the second floor, but they all were wrong. The elevator was a success from the start and all the offices had tenants very quickly. The owners were so encouraged that they had plans made for a new building of nine stories and six elevators. However, this was not realized until 1887.

Before steel framework was seriously proposed for building construction, many other methods had been tried, but it was impossible to build "fireproof," in the real meaning of the word, with brick, wood, stone and cement. Buildings arose to ten, twelve and even thirteen stories, but the floors, trusses, stairs and elevator enclosures were built of iron, not only to prevent decay and burning, but because the former method of fireproof construction in partitions and floors added so greatly to the weights to be borne.

With the adoption of iron in the vital parts of the construction and the use of hydraulic and electric rapid-running "express" elevators, with a speed

of 60 feet a minute or more, the problem of space for a time seemed to be solved and buildings thirteen and fourteen stories high were replacing old structures.

But a new difficulty arose: the brick walls at the base became thicker than ever, and their cost was enormous; their weight, too, was excessive for the foundations, and it was soon found that the ground space they occupied caused great loss to owners. So thick, in fact, were the walls at that time that if an owner built on a narrow lot he had little more than an entrance hallway between the side walls on the ground floor.

Iron construction became an absolute necessity at this juncture. "Necessity became the mother of invention," and from cast iron fronts, riveted girders and trusses, the builders of iron bridges came to the rescue and produced the skeleton framework which made the buildings of fifteen, sixteen, nineteen, twenty and twenty-five stories arise all over the city. It is only forty-three years since the installation of the first elevator in a New York City office building, and about a quarter of a century since the first steel skeleton was erected to be enveloped in stone or terra cotta.

Since the dawn of the twentieth century steel frames in construction have been brought to greater perfection and are protected from moisture and rust by preservatives. The confidence of capitalists seems to have no limit in building construction and there even appears to be some sort of rivalry in the projection of steel and stone toward the clouds. The most attractive examples of tall buildings to-day are: the Times Building; the Metropolitan, 700 feet above curb; the City Investing Building, 500 feet; the Singer Building, 612 feet; the Municipal Building, 560 feet; and the greatest and noblest of all, the Woolworth Building, 785 feet above the sidewalk.

A new era in building construction has undoubtedly dawned with the completion of the Woolworth Building, and, more than ever before, capitalists from other business centers will be tempted to invest in the production of real estate in New York City. One glance at the Woolworth Building will satisfy even the skeptical mind that it will point the way to the beautiful as well as the useful in building construction. Why should it be otherwise? New York City has had its choice of the architectural and engineering skill of the world. It has had its choice of the Master Builders in every branch, and skilled builders are not too optimistic in declaring that New York City is destined to become the most important commercial center of the world. Then why should it not be the most beautiful city?

THE MASTER BUILDERS' MASTERPIECE OF BUILDING CONSTRUCTION

TRULY the architect of the majestic structures of steel and stone of to-day creates a new architecture that has its affinities in every branch of modern engineering science as well as the records of past ages of building construction. Even when he designs, plans and specifies for the creation of a great and wonderful structure like the Woolworth, he must seek the aid of Master Builders who have the knowledge and the machinery and the skill at command to make his dream a reality. The great modern contractors solve this problem in the first instance. They have combined forces of skilled and trained men at their command. The designs and plans are studied and specifications followed to the minutest detail, and the Master Builders are selected, not from the lowest contract, but by reputation, and the character of material or appliance and high quality of work. There is no time or opportunity for equivocation in a vast undertaking like the erection of the Woolworth Building, where ten thousand problems must be practically solved.

The Master Builders were well chosen for the building of the world's greatest structure, and the problems have all been solved to the satisfaction of the owner, the architect, the contractors, and the result is a created mountain of stone and steel of wonderful external and internal beauty and usefulness. From every point of view, the level of the street or the tops of the neighboring buildings, the ornamental effects of the facades of the various floors command the admiration of the most critical. The sharp outlines of the curves and floral forms are always to be observed, which is abundant evidence of the remarkable scale study which has made this possible. And the same care and precision prevails in every department of the construction of the Woolworth Building.

The citizens of New York and the rest of the intelligent world will no doubt be interested to learn who really built this wonder of the city, and to follow its development from the digging of the foundations to the hoisting of the flag at the top of the structure when the great work had been accomplished; and this book has been prepared for that very purpose. The Master Builders of the foundation, of the steel framework, of the walls, the masonry, the elevators, the machinery, the plumbing, the tiling and terra cotta, the carved marble, the roofs, the golden tower and the interior furnishings, are well deserving of a modicum of praise, as well as some account of their achievement in this historical record of an epoch in building construction.

Before describing briefly the technicalities of the interesting work of the Master Builders we give some details of the quantities of material used in the foundation and superstructure.

ARCHITECT AND ENGINEER

The architect was Mr. Cass Gilbert, and Mr. Gunvald Aus was the chief consulting engineer.

The general contract was given to the Thompson-Starrett Company—under the supervision of Mr. Louis J. Horowitz, who is the president of the company.

PREPARING FOR FOUNDATIONS BY FOUNDATION TEST BORINGS

Owing to the extraordinary character of the building proposed, it was essential that a thorough investigation be made to determine the positive character of the geological condition existing between the surface of the ground and rock, also the nature of the rock itself, as a preliminary to preparing the plans and specifications for the foundations. The firm of Phillips & Worthington, having had long experience in that particular line of engineering, was engaged by Architect Cass Gilbert to conduct such underground investigation by making borings by the hydraulic, auger and diamond drill processes to register the depths the caissons would have to be sunk to rock, and to drill into the rock not less than ten feet to be absolutely certain it was bed rock and not boulders. They found the average depth to rock below curb to be 116 feet.

PREPARING FOR THE FOUNDATIONS

Work was commenced in September, 1910, by the wreckers who razed to the ground the five- and six-story buildings previously occupying the site, and removed their materials. On November 1, 1910, the foundation contractor commenced removal of the walls, footings and floors, from street level down to about fifteen feet below the curb. Walls of buildings adjoining the site were temporarily supported on heavy I-beams, jack-screws and cribbing, while they were underpinned with new concrete footings carried down about forty feet below street level and beyond the new general excavation.

A GREAT FOUNDATION

The foundation work and other underground work was done by The Foundation Company.

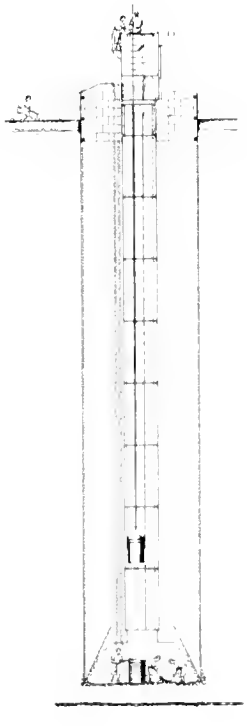
The foundation of a building rising seven hundred and eighty feet above the curb must be a foundation which can be depended upon, not only to bear the enormous weight in thousands of tons of steel and stone of a great structure, but to bear the stresses caused by vibration and wind. The whole burden must be carried by the foundation, and the greatest engineering skill is necessary to sound beneath the curb to learn the nature of the ground wherever the foundation is to be constructed.

The weight of the structure must be equally distributed at given points on piers and columns, and the weight reduced to an average. The New York building laws are wisely made in the interests of safe building construction so far as the foundations are concerned.

Test borings on the site of the Woolworth Building discovered rock at one hundred and thirty feet below the surface of the street. Solid rock was most desirable for the foundation of a structure which would weigh 250,000,000 pounds and tower into the air higher than any other structure in the world, but it must not be forgotten that the nature of the ground, even though it be of solid rock, is not so important as its compactness and consistency throughout, or so important as the thorough, skilful engineering construction of the caisson monoliths, piers and piles whereon the stresses of the building are distributed.

The many borings made by the engineers disclosed loam, gravel stone, shoal water, quicksand and solid rock, and at the great depth of 130 feet below the curb was commenced the problem of building the piers and monoliths which should be impervious to shifting sand and form a solid construction equal to the enormous load.

As may well be imagined, many complications arose in the excavations, owing to the limited area of the site and the great depth of the foundation, but the engineering skill brought to bear on the situation, together with the latest appliances and machinery, were equal to the task, and gradually the foundation became a wonderful mass of solidity, prepared for the walls and the column of the great structure.



BUILDING THE FOUNDATIONS

With one possible exception, the underground work of the Woolworth Building called for the largest single pneumatic caisson contract ever let in New York City, or elsewhere. This work consisted of two main items, the sinking of the piers and the deep cellar excavation.

Sixty-six reinforced concrete piers, from ten to twenty feet in diameter, were sunk approximately one hundred and ten feet deep. They were installed by the pneumatic caisson process, and founded on bed rock. The material penetrated consisted entirely of the most treacherous material known to builders and engineers—quicksand. The design of the caissons was in accordance with patents held by the Foundation Company, a typical cross-section of one of these being shown in accompanying cut.

After the piers were completed, the erection of the steel work began at once, it being possible to do this because of special cofferdams which had been installed on the tops of the piers. This saved considerable time in the ultimate completion of the building, inasmuch as the steel work was not delayed by the general cellar excavation, both departments of the construction work being conducted simultaneously.

The main cellar and sub-cellar were forced by first driving heavy steel

sheet piling around the entire site. When this was done the sand was excavated and hoisted up through the steel work of the building, and discharged into trucks on the street. The steel sheeting was braced to the steel frame of the building. When it is remembered that this cellar was 55 feet deep, and partly in running quicksand, below water, and that 25,000 cubic yards of the quicksand was taken out without interrupting the general work on building, and without jeopardizing the large buildings on all sides, the difficulty of the problems will be better understood and the achievement appreciated.

This total of the underground work involved an outlay of *one million dollars*, and was accomplished in less than contract time by The Foundation Company, of 115 Broadway, New York City.

MATERIALS FOR FOUNDATION AND SUPERSTRUCTURE

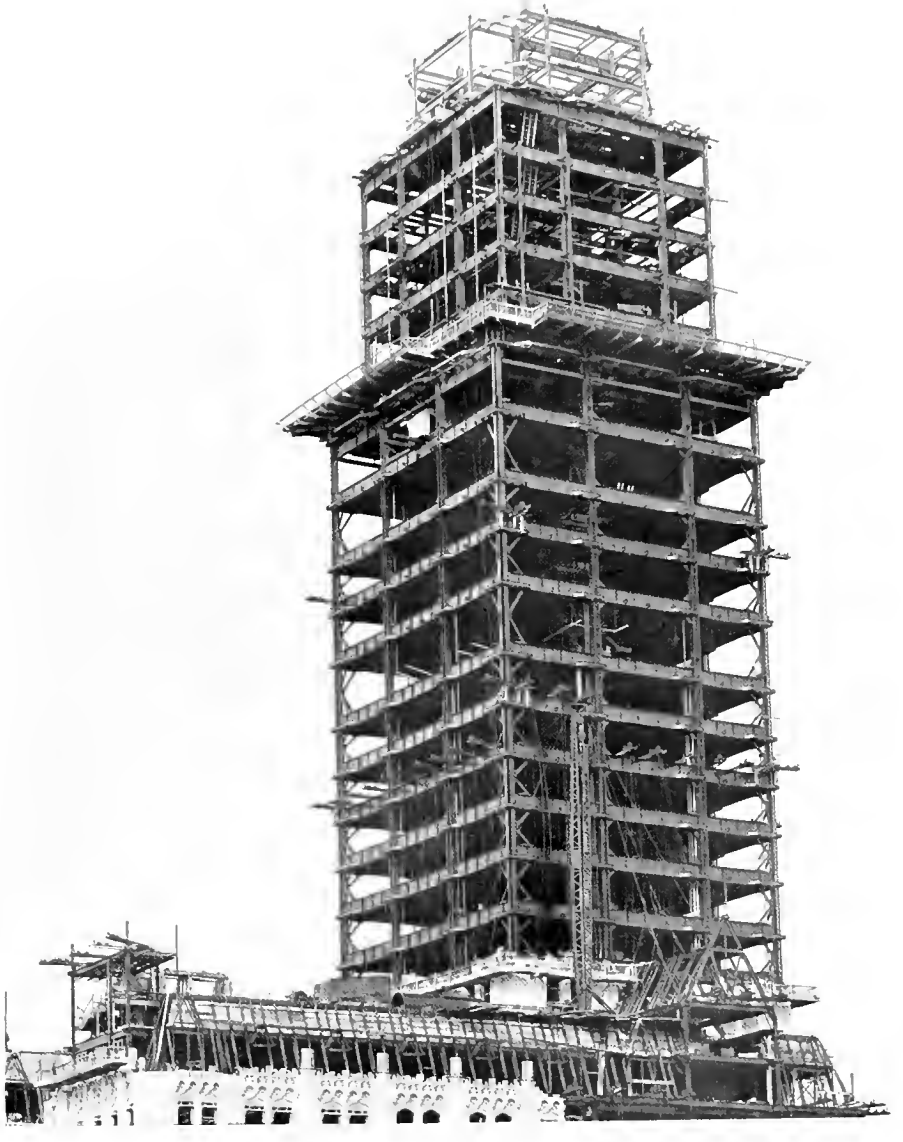
The principal quantities involved in the building of the Woolworth include: for the foundation, about 6000 yards of excavation, 24,000 yards of concrete, 300 tons of reinforcement steel, 10,000 linear feet of wooden sheet piling for the general excavation, and 20,000 square feet of wood and steel sheet piling for the boiler room and other excavations in the cellar.

In the superstructure there are about 23,000 tons of structural steel, 17,000,000 common brick, 7,500 tons of terra cotta, 1800 square feet of floor tiles, 1,800,000 square feet of partition tiles, and 2,500 square feet of cut stone.

SKELETON STEEL FRAME-WORK

The higher the ratio of available floor space in a building to the area of the plot which it occupies, other conditions being equal, the more profitable will be the investment. This area of floor space is mainly dependent on the number of stories and the space taken up by the walls and interior columns. In the heart of the New York business district, where every square foot of ground is very valuable, it is highly important to increase this ratio to the greatest extent possible. Before the introduction of the steel "skeleton" frame-work, the thickness of walls and cross sectional area of interior columns required to support the loads for buildings of over about ten stories high became so great as to seriously reduce the available floor and window space in the lower stories. On account of its great strength the "skeleton" steel frame-work carries the permanent, floor, roof, and wind loads, as well as the weight of the walls themselves directly to the foundations, with a comparatively small loss of floor and window space, for a height of building far exceeding that possible in any other type of construction. Only in recent years has this type of construction reached the degree of perfection required to build such a gigantic structure as the Woolworth.

The design of the steel work for this building does not embody any strikingly new features, but it does include to an unusual degree a combination of many of the important developments for structures of a similar class.



SKELETON STRUCTURE OF WOOLWORTH BUILDING
STEEL—AMERICAN BRIDGE COMPANY

The great height of the building and the wind load assumed develop enormous stresses in the steel work and necessitate the use of huge columns and girders. The sixty main columns support an estimated weight of 125,000 tons, the maximum load on one column being about 9,500,000 pounds. The greatest

cross sectional area used for a single column is about 700 square inches. The heaviest column has a cross sectional area of 640 square inches, a length of 30 feet, and a weight of 45 tons. The columns rest on cast steel pedestals, supported by massive girders and grillages of beams, resting on reinforced concrete piers, which are taken to solid bed-rock at an average depth of 115 feet below the curb level. One of the foundation girders weighs 65 tons, is 8 feet deep, about 6 feet wide and 23 feet long. This girder was taken from the lighter to the building by a 100-ton truck drawn by 42 horses.

The wind load of 30 pounds per square foot, which is equivalent to a velocity of about 80 miles per hour, is very severe when considered as acting on such a large area at one time, and the stresses resulting from this assumption are necessarily very large, but the final result of proportioning the steel work for such a condition gives a very rigid structure. The maximum wind load on a single column is 2,500,000 pounds, with an additional bending stress from the portal bracing of 200,000 pounds. Wind bracing in the form of brackets, curved portals, knee braces, gusset plates on deep plate girders and diagonals from floor to floor for the tower (below the fourth floor) transfer the wind stresses to the columns, no reliance being placed on walls and partitions except those parallel to the long sides of the building. The tower was considered as a unit by itself, and the columns and wind bracing are proportioned to carry the load directly to the ground, without the aid of the main portion of the building. This is another rather severe assumption on the side of safety. The 60-foot by 110-foot wings of the "U"-shaped main building are connected across the 35-foot interior court by portal struts at about every fifth story, for the purpose of general rigidity and making the wings act as a unit in resisting wind pressure.

The 24,000 tons of structural steel required in the construction of this building were furnished by the American Bridge Company and fabricated in its Philadelphia and Pittsburgh plants in about 45 weeks. The assembling and riveting together in the shop of the huge girders and columns was only accomplished in the highly satisfactory manner obtained by the aid of the most modern shop appliances.

THE WIND-BRACING

Owing to the great height of the tower of the Woolworth Building, careful calculations were made by the engineers regarding elasticity, vibration and the danger from wind-pressure, and a system of wind-bracing was designed to protect not only the tower but every part of the building from both ordinary and extraordinary vibrations or wind forces.

It was assumed that the high wall areas might be exposed to a pressure of thirty pounds per square foot, which would be transmitted through the steel framework to the tops of the concrete piers about thirty-five feet below the curb level. No reliance could be made on the walls and partitions except those parallel to the long sides of the building. The tower was designed independently, as though it stood alone.

In the tower the inclined members of the pyramidal roof provide wind-bracing from the top down to the fiftieth floor, and from the fiftieth to the forty-seventh floor the wind stresses are carried to the four interior columns, with gusset plate connections to the floor beams. From the forty-seventh floor to the forty-second floor the wind stresses are carried down through the outer columns, with solid web knee brace connections to the wall girders, and from the forty-second to the twenty-eighth floors the bracing consists of deep wall girders and knee braces; below the twenty-eighth floor it consists entirely of solid-web full-depth plate girder portals.

The two wings of the building, 60 by 110 feet each, are connected across the 35-foot interior court by portal struts at about every fifth story. The transverse columns in each wing are connected at each floor by double lines of continuous deep plate girders with gusset plate connections.

The maximum direct compression from wind stress in a single column is 2,500,000 pounds, with the addition of 200,000 pounds flange stress from the portal bracing.

On the Broadway front the bracing of the tower consists of double plate girder portals with flange angles. In the basement and sub-basement the portals have the bottom flanges reinforced by cover plates extending around the curved portion of the flange. From the tenth to the twenty-seventh story all the panels are braced with single portals having pairs of flange angles which are provided with top chord reinforcement plates from the fifth to the fifteenth story in the corner panels. From the twenty-eighth to the fortieth stories the Broadway face of the tower is braced by wall girders. At the forty-second floor, where the upper stories of the tower are offset about seven feet inward, the depth of the wall girders is increased and knee braces are omitted. From the forty-third to the forty-sixth story the wall girders have the same uniform depth and are connected to the columns through gusset plates projecting beyond the top and bottom flanges to form knee braces at both ends in the center panel and at one end in the side panels.

In the four lines of columns perpendicular to the Broadway face of the tower the bracing consists of plate girder portals which are double and have flange angles to the fifth floor, above which they are single. Above the fourth floor the bracing in the west face of the tower is the same as that in the Broadway face, but below the fourth floor architectural considerations permitted diagonal braces. The basement and first floor girders are plate girders, and those on the second, third and fourth floors have pairs of 15-inch angles back to back.

COMPLETING CELLAR EXCAVATION

When the steel framework was well advanced, the two lines of rangers for the sheet piling on the lot lines were braced against the lower sections of the steel columns, and the original braces and pushers were removed to permit the excavation to be continued to sub-grade of the cellar floor at a depth of nearly forty feet below the curb. The excavation consisted entirely

of sand. The soil was drained by a large central sump sheeted down to a depth of fifty feet below the curb and equipped with a 10-inch centrifugal pump which gradually lowered the ground water level more than two feet. The excavation for the boiler-room pit, sixteen feet below that of the general cellar floor level, was made by hand inside of steel sheet piling.

REINFORCED WALLS

The walls are reinforced by vertical 12- to 20-inch I-beams about three feet apart, on centers, framed into horizontal channels at the top, bottom and middle of the wall. Above ground water line the walls were built by the general contractor, who set up wooden forms clear of the exterior steel sheet piling and rangers and enclosing the reinforcement beams and channels. The forms were filled with machine-mixed cement and stone.

THE EXTERIOR WALLS

Enclosing the steel frame in the exterior walls about 17,000,000 common brick were used, besides 7,500 tons of terra cotta.

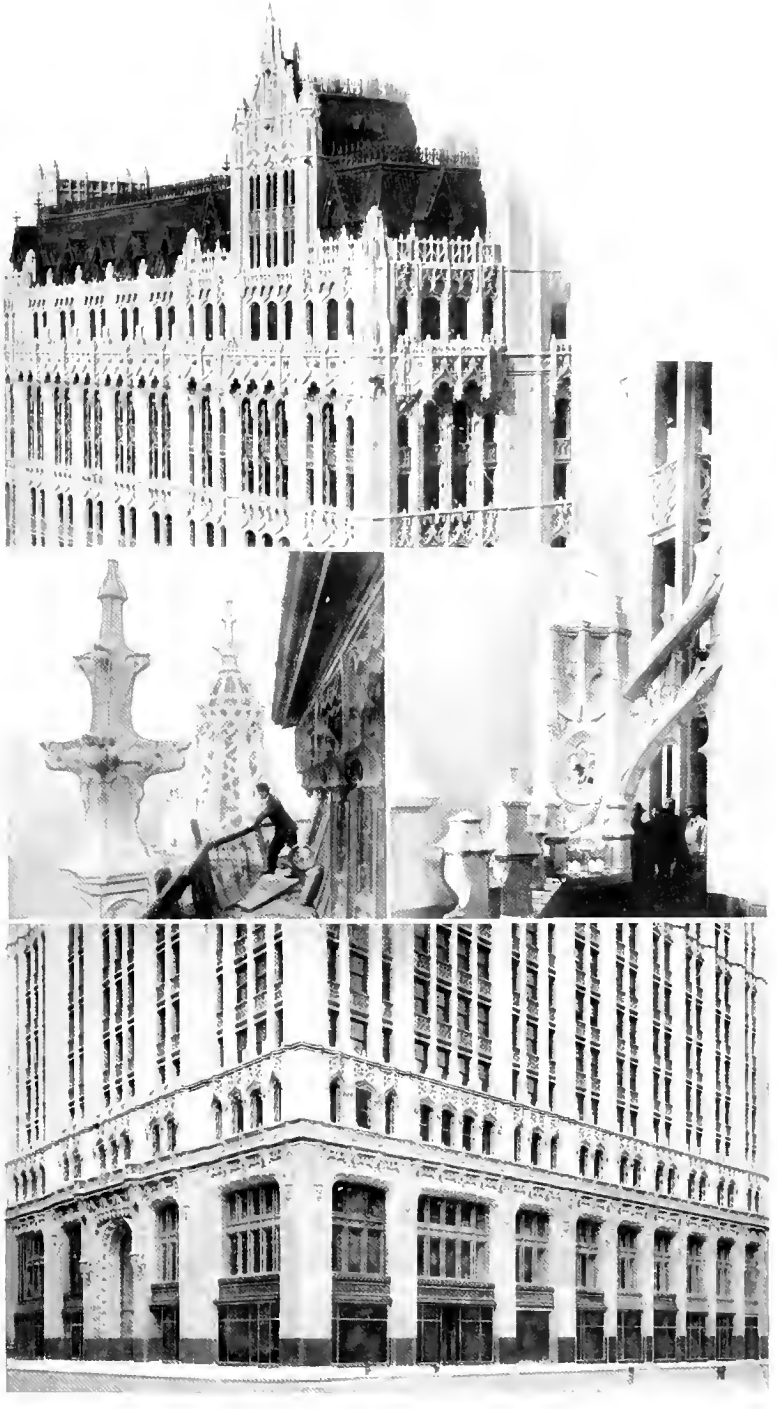
Up to about seven feet above the curb line the exterior walls are of polished granite, from Rockport, Maine, and from that elevation to the fourth story sill course they are of Bedford limestone, above which point the walls are built with terra cotta blocks. Both the stone and terra cotta are backed by common red brick.

William Bradley & Son, cut stone and marble contractors of Long Island City, N. Y., furnished approximately 1,400 tons of limestone for the lower portion of the building.

THE FLOOR CONSTRUCTION

The lower floors are of concrete, twenty-four inches in thickness in the boiler and engine rooms, and twelve inches in thickness in the sub-basement, laid on the surface of the ground.

The floor tiles were laid on 2 by 6-inch centering planks, supported on 4 by 4-inch joists suspended by 7/8 inch hook bolts about 4 feet apart on centers. The upper ends of the hook bolts passed through cantilever plates and took nut and washer bearings 4 by 4-inch cushion pieces on top of them. The 2 1/2 by 1/4 inch standard cantilever plates were about 10 inches long, and at the anchor end were hooked over the top flanges of the floor beams, beyond the other side of which the cantilever ends projected to receive the hook bolts and were punched with two holes, spaced to clear different widths of beam flanges. The hook bolts were adjustable by their top nuts sufficiently to allow the centering planks to receive the soffit tiles below the bottom flanges of the floor beams, and then were screwed up tightly, holding the entire construction in place.



SOME OF THE EXTERIOR ARCHITECTURAL DETAILS

LIME STONE FOR LOWER PORTION OF BUILDING FURNISHED BY WILLIAM BRADLEY & SON

THE HOLLOW TILE CONSTRUCTION

All the floors above the street level are of hollow tile, except two pipe gallery floors, where stone concrete slabs, four inches thick, are used. The arches are the familiar type of side construction skews and keys, with end construction lengtheners. Twelve-inch arches used 12-inch I-beams, and 15-inch arches 15-inch I-beams. Where the beams are deeper than 15 inches a raised skew is used, with 12-inch arches. All girders are encased in hollow tile. The contractor had the option of fireproofing the columns with stone concrete, or with hollow tile with cement mortar poured in to fill the space between the blocks and the steel work, but concluded that hollow tile would be most satisfactory.

The columns in the lower stories were fireproofed with stone concrete. On account of the obstruction caused by numerous pipes, it was found difficult to continue this method, so recourse was had to the "cement gun," which proved so satisfactory that its use was approved and all the columns and windbracing in the upper stories were encased in mortar thrown on by the "gun." Thus the steel is protected from corrosion by the Atlantic Portland cement mortar, and the whole construction from fire by the blocks.

All partitions are of four-inch and six-inch hollow tile. All wall furring is of two-inch and three-inch hollow tile. The following are the approximate quantities of hollow tile used in the building: 750,000 square feet floor and roof arches, 210,000 square feet girder covering and 1,500,000 square feet partitions and furring, or a total of 28,000 tons.

CEMENT IN THE GREAT BUILDING

No less than seventy thousand barrels of Atlantic Portland cement was used in the general construction of the Woolworth Building.

This quantity of cement for one building appears staggering at first, but when the enormous height of the structure and the extraordinary depth of the foundations are duly considered, seventy thousand barrels of cement, for a building weighing one hundred and twenty-five thousand tons, does not seem much after all.

The contractors were well aware of the importance of using an absolutely reliable product when they specified and contracted for this particular cement. Even the great vaults of the Irving National Bank, which are part of the Woolworth Building, are built of Atlantic Portland cement and steel. The many millions of dollars in securities to be protected, besides the exceptional size of the building, demanded extraordinary strength and durability.

It must not be imagined that Atlantic Portland cement was chosen for this important building without careful tests. The architect, general contractors and engineers made an incisive investigation of all brands of cement, and it was only after prolonged tests and analyses that the cement which

proved to be the most satisfactory was decided upon. This was the Atlantic. It was no matter of chance or favor, but the result of scientific merit. The wisdom of those who selected the Atlantic cement for the Woolworth is fully justified by the fact that this cement was chosen, after severe tests, for the Municipal Building, the highest apartment house, the largest hotel and the tallest loft building in New York City, besides great engineering projects, such as the Manhattan Bridge, and Blackwell's Island Bridge over the East River, and the Chelsea piers on the North River, which operations were under the supervision of the cement engineers of the Bridge and Dock Department, who have recorded the results of their tests of the Atlantic Portland cement and the complete satisfaction obtained.

The manufacturers of the Atlantic Portland cement have gained a high reputation for their product only by maintaining the high quality, and architects, contractors and engineers find they can rely upon it where the use of the best cement the world can produce is paramount.

THE TERRA COTTA FACADES

The entire visible facades of the Woolworth Building are made strong and beautiful with terra cotta. From the third story to a height of eight hundred and seventy-seven feet, viewed from the north, the south, the east and the west, the rich Gothic designs are plainly to be seen and admired, marking every window and each story by the sharp outlines and exquisite figures, curves and scrolls.

When the Etruscans made their sarcophagi and their ornaments in building or wares in this useful material, 250 B. C., they gave evidence of wonderful ingenuity and study. Archeologists believe that the material made by the Etruscans was superior to that made to-day, but it must be considered that the ancients used it in making vases and valued ornamental figure construction, such as sarcophagi, whereas to-day these things are made of more costly material. The terra cotta of to-day is a plasha mixture of clay and other substances which can be moulded by hand or machine, perhaps, to architectural forms and baked to a hardness and toughness useful in building construction. It is somewhat less costly than carved stone, and allows greater scope in design, besides being lighter and more suitable for lofty buildings, especially towers.

The prevailing color of the terra cotta on the Woolworth Building is a delicate buff, varying slightly in tone, and wherever a modeled design is in evidence it is thrown into relief more strongly by soft shades of blue, green or golden yellow.

The terra cotta work on the Woolworth Building was commenced February 1, 1912, at the fourth floor of the court walls and at the sixth floor of

the front walls. It was continued at the rate of one to one and a half stories each week, the work being entirely controlled by the deliveries of the blocks.

AMERICAN MARBLES PREDOMINATE

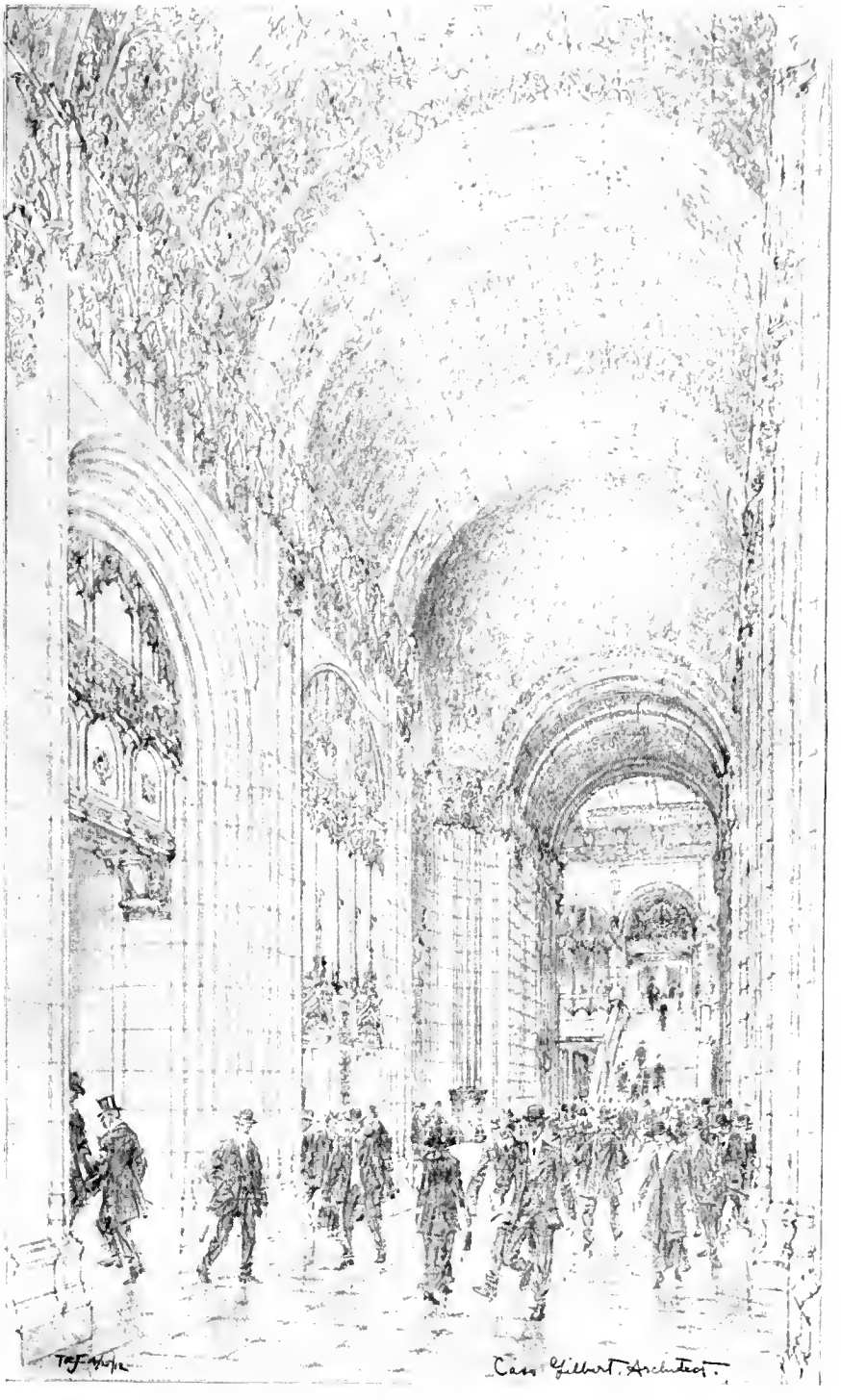
No cultured visitor to the Woolworth Building will fail to admire the polished and carved blocks and beautiful carvings of exquisitely colored and shaded marbles. The richness of the marble wainscoting, the panelling of the walls and the Gothic carving must impel an impression of lavish expenditure as well as unusual artistic advancement and determination to outrank all other buildings in majestic embellishment. There are over 700 steps in the stairways, and it is worth while for an American, especially, to walk up and admire the marble product of the United States. All the qualities of famous Italian marbles are to be found in the marbles of Vermont, which substantially adorn the wainscotes or the walls of the Woolworth. The deep, warm colors, the variety of shades and delicate tints are all there, Green Vein Cream Paonazzo marble and American Siena from the Eastman quarries of West Rutland, Vermont.

The marble worker knows the quality of marble by its polish, its compactness and the way it holds the arris in carving. The Gothic carvings in the main corridor will bear the scrutiny of the critic; the polish is almost dazzling and the arris is perfect, while the marble itself laughs with ripples of exquisite green shades on a sea of delicate cream yellow. The marble was furnished by Tompkins-Kiel Marble Company, of New York City.

The carving was executed by Wm. Bradley & Son, of Long Island City; the marble was polished by them and, in fact, the marble throughout the building was selected and the work executed by them.

Vermont possesses the largest marble quarries in the United States, if not the largest in the world. Fifty years ago the quarries of Rutland were operated by ox teams and hand work of the crudest form, but half a century has wrought a remarkable change. The vast quarries there are now as much alive with modern machinery and appliances as the busiest Italian quarries at Carrara. Electric cranes and derricks move the huge blocks of marble in every direction, and channellers are busy dividing huge blocks for shipment. One of the finishing rooms at the Rutland marble quarries is 1000 feet long, and contains scores of gang saws cutting up the marble into various shapes.

The most beautiful Paonazzo marble is recorded by the Romans as "opaline in its play of colors." Doubtless, if the Romans had seen the beautiful Green Vein Cream Paonazzo marble of the Eastman quarries of West Rutland, they would have counted it among their valued products. The American Siena from the Eastman quarries also rivals the famous Giallo de Siena in variety of shades and depth of color.



MAIN HALLWAY

MOSAIC GLASS CEILING · HEINIGKE & BOWEN
MARBLE · TOMPKINS-KILL MARBLE WORKS
MARBLE FINISH · WILLIAM BRADLEY & SON

MARBLE—TOMPKINS-KIEL MARBLE COMPANY
CARVING—WILLIAM BRADLEY & SON

THE MARBLE HALL

It is impossible to visit the Woolworth Building without stopping to admire the exquisite beauty of the main approach to the interior. At the end of the corridor, opposite the Broadway entrance, is a marble stairway leading to the Irving National Bank. The beautiful marble carvings are Greek in design and executed with marvellous skill. The ornamental metal work is principally wrought iron, covered with pure gold. William Bradley & Son executed the marble work in the main hall and in the Irving Bank.

As one enters the main corridor, the grandeur of the marble work is most appealing. The pink and golden veined marble, lining the walls and in the grand stairway, was brought from the famous Skyros quarries of Southern Greece.

The wonderful frieze course of such intricate design is carved from the choicest blocks of Vermont marble. The bank rooms have been finished in a pleasing and mellow tone of dark cream marble (Tavernelle).

Passing through the upper corridors, it is decidedly pleasing to notice that the usual custom of repetition has been avoided. Various marbles have been used for the corridor wainscot, and no two consecutive floors are alike.

No greater quantity of such valuable marble has ever been used in a commercial building, and but few buildings of any description possess a like value of interior marble.

This vast quantity of marble, so skillfully worked, and erected in contract time, speaks well for the efficiency of the plant and organization of William Bradley & Son, Long Island City, who were the contractors for all of the marble work in the Woolworth Building.

THE GLASS MOSAIC AND LEADED GLASS

It is not absolutely necessary to visit Venice in order to view some of the most pleasing effects in mosaic glass. The ceiling of the main hall in the Woolworth Building is an entrancing mass of varying tones of light and color. The banking rooms on the floor above are even more attractive in their subdued beauty, but all material, carvings and colorings are genuinely artistic and in keeping with the general character of a structure of uncommon beauty. All the glass mosaic and leaded glass work was executed by Heinigke & Bowen, and it unquestionably represents the most costly as well as the richest class of mosaic work ever contracted for in a business building.

The ceilings of the main and transverse halls are decorated, forever, in a quality of color which can be arrived at in no other permanent material.

Mr. Gilbert's sketch suggested a treatment in perfect sympathy with the other decorations.

The simple palette, direct system and vigorous methods used by Heinigke & Bowen in carrying out the sketch recall the great mosaics of Revenna and Rome, rather than the more labored Venetian decorations, though the mechanical processes and the size of the two and a half million individual tesserae are more like the latter.

The leaded glass ceiling lights over the main stair and the banking room, executed by the same firm, have the same sympathy with the spirit which pervades this building. That of the bank is severely conventional and merely continues the coffer paneling of the plaster, but the one over the stairs combines a quite free vine treatment with a bit of sentiment in the form of coats-of-arms of the great mercantile nations which have contributed in building both the monument and the fortune which conjured it.

THE STONE CARVING AND MODELLING

The carving and modelling are usually entrusted to the contractor for stone, marble or terra cotta, who in turn gives the work to the lowest bidder. This lack of system often results in inferior work, which is traceable in many pretentious buildings. In the Woolworth Building, however, wisdom predominated and the architect made the selection of the men who should do the carving and modelling. It was a matter of importance that the artistic effect of the entire construction should be maintained in every detail. John Donnelly and Eliseo V. Ricci were awarded this important contract. They executed the carving with wonderful skill and made the models for everything in the building which had to be specially designed and made, from the door knobs to the copper finale on the tower.

MODELLING—DONNELLY & RICCI

Many architects are beginning to realize that the subletting of important contracts where the artistic element is paramount is apt to result in inartistic effects which bring great disappointment, often too late for alteration.

THE PLASTERING, PLAIN AND ORNAMENTAL

The plastering, decorative and plain, throughout the Woolworth Building was executed by H. W. Miller, Inc. It is doubtful whether a contract covering such a large extent of surface has ever been made with any one firm of plasterers before. Over two and one-half million square feet of surface had to be covered, involving six million pounds of gypsum plaster.

The contract called for the best work possible to be done and the best materials, and H. W. Miller, Inc., accepted, knowing that they could command the finest materials, that they had a superabundance of the most improved tools and appliances, and what was equally as important, that they had a staff of skilled and experienced men in every branch of plastering work.

The work ranged from plain surfaces, sand or stone finish, throughout the various moldings, panelings, embellishments and decorative pieces of fine detail, to the gorgeous domes and ceilings of hallways, the Irving Bank and the vaulted ceiling of the rathskeller and the ceiling of the grand entrance corridor.

H. W. Miller, Inc., with their army of efficient workmen and appliances, performed difficult work under many trying conditions, but, like all true workmen, they mastered every difficulty and met without friction the requirements of marble masons, decorators and others who had to take part in the work inside the Woolworth Building.

PLASTERING—H. W. MILLER, Inc.

The keen eyes of the inspectors appointed by the general contractors to scrutinize all work, examined the plastering with unusual care, not because they doubted the ability of H. W. Miller, Inc., to maintain the high reputation already made, but because verification was an absolute necessity. Workmen grow tired occasionally and odd corners may be overlooked.

The X-ray eyes of the Thompson-Starrett Company's supervisors, however, were equal to all emergencies, and from the basement to the topmost rooms in the tower, day by day, as the work was executed, the examination proceeded and finally the report was made. Every suggestion of the inspectors was attended to with care, and the work pronounced all that could be desired. This was surely the foundation of a reputation for any firm to have succeeded in a great and arduous task like the plastering of the Woolworth Building.

Plastering is by no means a new art, as some may imagine, for the covering up of defects or smoothing of walls. The pyramids of Egypt contain plaster work which must have been executed four thousand years ago, at least, but which is hard and durable to-day, and, strange as it may read, it is nevertheless true, that the tools in vogue at that time are identical with the common tools of the plasterer to-day.

PAINTING THE INTERIOR

Surely the painting which occupied 150 skilled men six months in one building deserves more than a passing notice. The building was a most exceptional one, the tallest in the world in fact, as we are pleased to repeat, and the contract called for thorough and skilful work.

The work of the W. P. Nelson Company consisted in painting the plastered walls and ceilings of offices, corridors, toilets, stairhalls, barber shop and engine rooms, and the finishing of elevator fronts in gold and metallic paints. In a structure over fifty stories in height the work might be measured in acres superficially, but the paint used amounted to no less than 7,500 gallons.

None but a concern equipped with a perfectly organized staff of capable workmen could have undertaken the painting of a great structure like the Woolworth. In addition to this there must be scientific knowledge of materials and the application; adequate tools and appliances besides careful, unfailing management of men. This is precisely the equipment of the W. P. Nelson Company, and the architect and the contractors knew it by their great reputation for fulfilling their contracts with absolute satisfaction, which is just what they did in the Woolworth.

One of the noticeable features in connection with the rapid advance made in building construction during recent years is the parallel advance of materials, products, appliances, accessories and men, to make the architects' designs realizations of strength and beauty. Steel frames and cement appeared when they were most needed, when business districts were overcrowded and great office buildings were really a necessity. Foundation-building improved and modern invention met every requirement. The painters' and decorators' art and science has not been sleeping, and to-day a giant organization like the W. P. Nelson Company can cover a mammoth temple of finance with a coat of white enamel paint in so short a time as the builders demand.

DECORATIVE PAINTING IN THE BANK

Through the resplendent corridor with its rich mosaic ceiling—up the grand marble staircase, one enters the spacious quarters of The Irving National Bank. One immediately feels impressed by the imposing character of this room, with its dominant notes expressed in the rich and luminous, yet subdued coloring of the ceiling.

The influence of Fifteenth Century Gothic is strongly and agreeably felt throughout the interior. The beautifully embellished coffered ceiling is executed in tones of old gold, warm greys and deep blues that strike the keynote of the complete color scheme and enhance the harmony of the entire room. A most successful result has been produced here, which not only beautifies the room but reflects the prevailing character of the building.

The Barnet Phillips Company designed and executed the decorative painting, under the personal direction of Mr. Cass Gilbert.

DECORATIVE PAINTING—MACK, JENNEY & TYLER, N. Y.

DECORATIVE PAINTING

The painted decoration of the main corridors and entrance halls of the Woolworth Building is the work of Mack, Jenney & Tyler, and in the execution of this work it was the constant desire to create a harmonious ensemble, reflecting at all times the spirit suggested by the architecture.

The color scheme of the whole ground floor was in a way predetermined and governed by the architect.

All plaster surfaces were decorated in conformity with this scheme in such a manner that it would impress the most casual visitor as one of great beauty, having been carefully studied and absolutely fitting and appropriate to its rich environment of bronze, marble, mosaic and leaded glass.

In the two lunettes of "Commerce" and "Industry" at either end of the large lateral corridors of the mezzanine floor the same quality of unquestioned suitability to the position they occupy was striven for. The choice of subject for the two magnified triptychs is obvious, in view of the purpose for which this building was erected.

In general the purpose has been to have the work in tune with its entire surroundings and thereby obtain a general harmonious effect and an attendant quality of richness, beauty and dignity, which a piece of work of this importance and character should possess.

MURAL DECORATIONS IN THE RATHSKELLER

Treatment of walls and ceilings is seldom matched by the unique splendor of the Rathskeller in the basement of the Woolworth Building. In a sense it is the culminating feature of the most artistic commercial structure in the world.

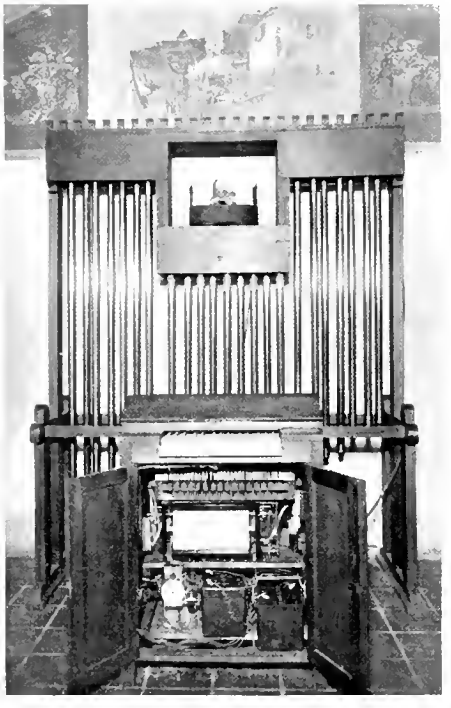
The unusual lighting effects, the pleasing, restful color scheme and the poetic, fanciful mural decorations on walls and ceiling all blend into an effect that is sumptuous and harmonious to a high degree.

MURAL DECORATION—FREDERICK J. WILEY
LIGHTING FIXTURES—EDWARD F. CALDWELL & COMPANY

The color scheme of the Rathskeller is a blending of cream-white, warm red and gold. The walls are white and great pillars of white rise toward the low-sloping, arched ceiling to merge with the brilliantly colored scenes depicted there. The mural decorations give the immense dining-room its tone and atmosphere. Mr. Frederick J. Wiley, the mural painter, designed and executed the Rathskeller's entire mural decorations.

The spirit that prevails is Fifteenth Century, although many of the scenes and some of the musicians, writers and poets pictured are distinctly modern.

The frieze on the walls shows individual figures of celebrities in characteristic attitudes and ensemble groups with just a touch of the grotesque to make them seem really human and interesting. It required the touch of a genuine artist to give to the groups the light, humorous touch. Medieval hunting scenes, towering castles, wandering troubadours, knightly horsemen, wind-driven galleons—all are pictured in a free, joyous spirit, poetic in conception, rich in color and design. Although he had the assistance of a dozen or more artists who worked under his personal direction, the general conception and many of the larger details were executed by Mr. Wiley personally. Artists and laymen who have seen the Woolworth Rathskeller pronounce it the most unique and artistic in the country.



CHIMES IN RATHSKELLER
YERKES SOUND-EFFECTS CO

THE MUSICAL CHIMES

A visitor to the Woolworth Building is naturally first impressed with its altitude, and this impression is deepened and strengthened by the wonderful view obtained from the highest portions of this monument to architectural progress and modern enterprise.

This view of a great city, lying at your very feet and yet so far away that its myriads of bustling citizens seem but Lilliputian travesties of themselves, can be likened to nothing else in the world. It is perhaps as the summit of a veritable metropolitan Alpine height, portraying the spirit of the times in its most exalted mood.

At the base of this mountain of endeavor, to fortify the climber before and to regale him after, lies a charming inn, so fashioned in its interior as to visualize the German bierstube that your memory loves, or that your favorite author has brought to your affections. A real bit of old Europe is this Rathskeller, as it is called; quaint in its conception, unique in its individuality, yet characteristic in its appeal, you fall in love with it at once.

And the Chimes! The deep-toned tubes of bell metal brass, animated by the god of modern science, heighten the illusion of the vision of the Fatherland in good old German songs that link the American to-day with the dear old yesterdays of a youth long past.

The chimes represent the last word in a field where music and science are true allies. They consist of eighteen tubes, mounted on a stationary rack especially constructed to fit the furnishing scheme of the establishment, and equipped with single stroke magnets. They are played automatically by means of a pneumatic player devised by Harry A. Yerkes, of the Yerkes Sound-Effects Company, who manufacture the Yerkes Temple Bells and Westminster Chimes. This pneumatic player is fitted with a clockwork attachment which acts as a kapellmeister to the brass choir, starting a number on schedule time at the striking of the hour.

In truth, you have not seen all the wonders of the Woolworth Building until you have visited the Rathskeller with its set of Yerkes Self-Playing Chimes.

The Yerkes Sound-Effects Company has its own factory building at 202 East Eighty-eighth Street, New York City, where it turns out its product for the wide world to enjoy, from Broadway to Melbourne, and from the Yukon to Mandalay.

BRONZE-COVERED FRAMES AND SASHES—UNITED STATES METAL PRODUCTS CO.

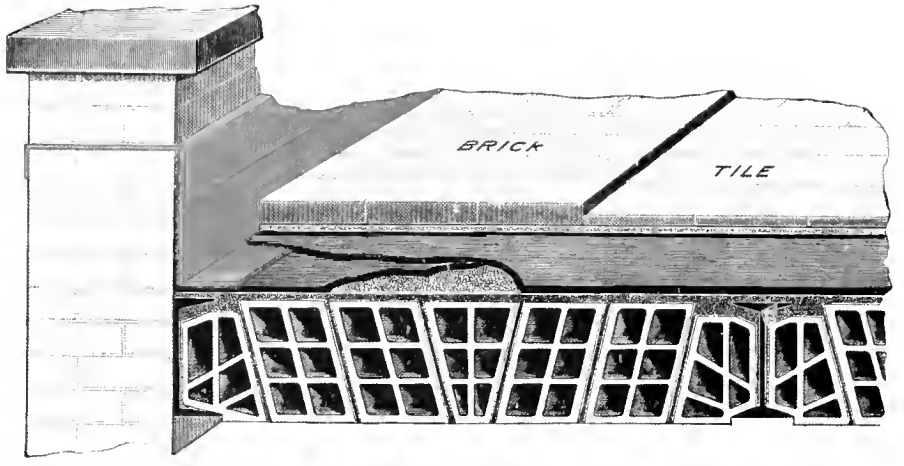
THE INTERIOR TRIM

The interior of the Woolworth is trimmed in a manner to set the ordinary conflagration at defiance. It is fitted with steel throughout the entire building. Wood was eliminated from the specifications altogether, and there are four thousand steel doors, miles of metal railing, picture moulding, conduit moulding, besides ten thousand feet of metal office partitioning.

Wire glass is used to protect those places which are exposed to fire risk from adjoining buildings, but everywhere else are bronze-covered window frames and sashes with hollow steel trim—3500 altogether. The elevator openings are enclosed in fireproof shafts, and all elevator doors are of iron, except those on the first story, which are of polished and engraved steel.

There are four stairways within the main building and two in the tower. These are enclosed with terra cotta partitions and are shut off from the public corridors by hollow steel doors. A fire escape is located at the end of the court and approached from the main corridor on each story.

The United States Metal Products Company executed the contract for the interior metal work very satisfactorily, furnishing more than 3500 bronze-covered frames and sash and hollow steel trim, several hundred thousand feet of hollow steel moulding, 3000 hollow steel doors, interior partition frames and sash, besides numerous other metal fireproof devices. All this material is finished in mahogany.



WATERPROOF ROOFING—T NEW CONSTRUCTION CO.

THE ROOFING AND VITRIFIED TILES

Great care was taken to ensure a suitable roof covering for the flat roof of the Woolworth main building.

A record of seventy years has proved that coal-tar-saturated felt and coal tar pitch waterproofing, when protected with vitrified tiles or bricks, makes the only genuine waterproof flat roof. This is the roofing which covers the flat top of the Woolworth Building. The vitrified tiles are laid in Portland cement. The architect and contractors are satisfied that the work was well done, and that there is every probability of the roof outlasting the structure.

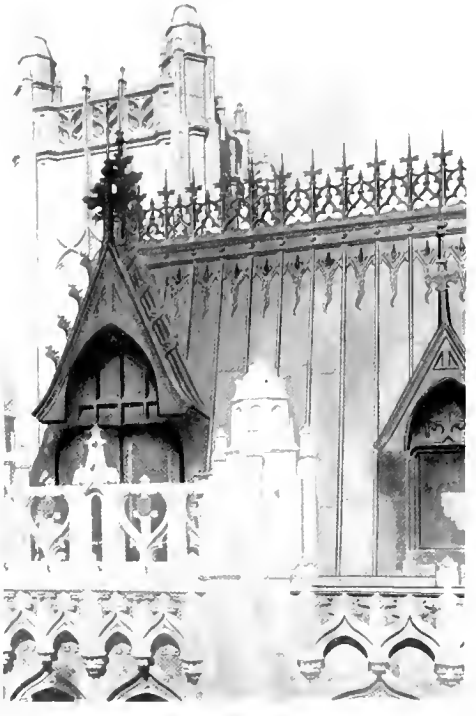
Cyrus Warren, away back in 1845, made many experiments with coal tar and felt in his endeavor to produce a waterproof roofing. He distilled the coal tar into pitch in order to cement tarred felt together in several layers on a roof, and coated the surface with hot pitch and gravel, thereby making the first built-up roof for flat roofs; and, after two-thirds of a century, the materials have proved to be the best and most economical as a rain repellant.

With the increasing scarcity of land in large cities, however, a demand came for a roofing that could be walked upon and that would even withstand considerable wear and tear. Such roofs were also required to be smooth as well as hard and tough and clean. A gravel roof could not be made smooth or kept clean, but the coal-tar-saturated felt and coal tar pitch roofing, protected with vitrified tiles laid in Portland cement, is both hard and smooth and durable, and can be kept scrupulously clean at all times.

Tobias New patented the basic features of the "T New Tile Roof," which is the name of the roofing we describe, and worked with Lewis W. Harrington, until his death in 1912, in endeavoring to bring the roofing to perfection. And Mr. Harrington, of the T New Construction Company, has gone along in his footsteps, improving on the old ideas until he has produced the roofing which was selected for the protection of the flat roof of the Woolworth Building.

THE ORNAMENTAL COPPER WORK

Many of the finest ornamental effects on the roof and the tower of the Woolworth Building are produced by heavy stamped sheet copper. The most elaborate portion of this work, as regards design and construction, is the pair of flying buttresses and a portion of the octagonal battery which surrounds the upper part of the tower. Above these are eight windows surmounted with pointed arches and tall gables, while additional small flying buttresses, swinging from the tops of the columns between these windows, brings us to the base of an octagonal cupola carrying a small dome, terminating in a point which becomes the base of the highest fin. Everything from the balcony up is left open, and the spaces, particularly the dome, are crossed by beautiful and fanciful traceries. In speaking of this tracery and that composing the great amount of cresting which stands upon the ridges of the several roofs, "Sheet Metal" says: "One cannot help noting what a great saving in labor is accomplished by the stamping press, for, as is known to designers, traceries are purely geometrical in design, consisting of regular curves the same in both outline and profile, and could, therefore, be made up by cutting and forming (or mold raising)."



STAMPED METAL WORK—WILLIAM J. KELLY

The stamped metal work was supplied by William J. Kelly, of Brooklyn, N. Y. The work, containing a vast amount of detailed elaboration, was executed with care and judgment and will remain a permanent evidence of what can be accomplished by the stamping presses in the hands of the skilled workers employed by William J. Kelly.

When Mr. Kelly was asked what his firm had done he simply said: "The work speaks for itself, but we are more proud of the modeling than the actual mechanical work, because in a great measure the success of architectural stamped work depends upon the modeling. We convinced the architect, however, that we understood even the modeling, and employed modelers who were artists in this particular work, and gradually we gained his confidence and successfully accomplished a stupendous piece of stamping work which we are very proud of."

ORNAMENTAL COPPER—HERRMANN AND GRACE CO.

THE GOTHIC COPPER-COVERED TOWER

The tower of the Woolworth Building, from the fiftieth floor to the apex, or more than one hundred and twenty-five feet, is sheathed in copper of a highly ornamental character. The design is strictly Gothic and in harmony with the facades of the building.

This beautiful work, together with the crestings, the domed windows from the twenty-eighth to the thirtieth stories, besides all the roofing and skylights on the main roof and courts, was executed by Herrmann & Grace Company, of Brooklyn, N. Y.

The members of this firm are well-known men of great experience in this particular work in the United States. They have covered many towers in the large cities with artistic copper sheathing, and one of their recent contracts was for covering the tower of the Singer Building, a work of unusual difficulty. Notwithstanding their experience and knowledge of their particular line of work, they confess to meeting many problems in fulfilling the demands of their contract for coating the tower of the Woolworth, which had no parallel in their previous experience, and that special conditions had to be met to enable them to do the work satisfactorily.

In the first place, the Woolworth tower is ten stories higher than that of the Singer Building, which meant that a much greater wind pressure would have to be contended with. This alone was a serious consideration; but in addition to this the Herrmann & Grace Company found that the Gothic design necessitated several thousand more parts of metal, and the problem of reinforcement proved a difficult one to solve because all the bracing had to be concealed so as not to mar the general effect of the design.

Then arose the question of guarding the lives of the mechanics who would do the work over 700 feet in the air under variable wind pressures. It was necessary to protect their lives, so well as the lives of the public in the streets below. Determination and splendid ability, however

mastered the difficulties. Scaffolding and outrigging were made specially to meet the necessities of the case, and the work proceeded amid several gales and wind storms which often reached a velocity of one hundred miles an hour; but there was neither accident to the men nor disturbance of a single piece of the work.

After such an experience in course of construction, there can be little doubt that the Gothic copper-covered tower of the Woolworth will retain its handsome appearance for a century or more, and the Herrmann & Grace Company deserves high praise for a great achievement under uncommon conditions of difficulty without an accident.

GOLD UPPER TOWERS

In the days of Nebuchadnezzar the great Babylonian temple erected to the god Bel, and called the "Imgur Bel," stood upon a square of brick measuring 1600 yards. The summit of the temple was surrounded by a figure of solid gold, forty feet high, representing the god Bel. This image must have weighed several tons. There was no gold leaf in those days, when the temples were topped with golden images. Whether the vast expenditure in decorating temples with images of solid gold was an expression of devotion to the particular god worshipped there or a means of attraction is not known.

THE GOLD ON THE WOOLWORTH TOWER

The effect of the gold amid subdued color effects on the tower of the Woolworth is very pleasing. "When the day is dull and things go wrong – look up at the Woolworth tower and smile."

Although the gilding on the tower was accomplished in the hot days of the summer months when pedestrians were sizzling along Broadway, the men dangling on the scaffold 750 feet above their heads were manipulating delicate gold rolls in a wind blowing forty miles an hour at least. "How did they do it?" is a natural question to ask, and the answer is, "By sensible methods." All the ideas worth having are coming to the United States, and the new system of making gold rolls on 60- or 70-foot lengths, and laying it over the ornamental copper sheet with a machine which allowed for every curve or circle or angle in the Gothic design, without puncturing or breaking the delicate rolls of precious metal in any way, is an idea which has come to remain. The old method of laying small leaves 3⅜ inches square would not have been practical in a gale of wind. It is really practical only in an enclosed strip for small signs.

The tower's copper sheeting of beautiful Gothic design was laid some months earlier, when winds were blowing fifty to a hundred miles an hour, but the metal was heavier, thicker and handled with less difficulty than the gold which was to make it beautiful. The atmosphere had tarnished the copper and it was necessary to clean it before the gold could be laid upon it. Acetic acid and a special cleaning powder were used to prepare it for pure gold, but the cleansing and painting were accomplished notwithstanding the gales

of wind, and the gold was carefully unwound for the machine and laid on the angles and curves of the ornaments to the extent of 40,000 square feet.

Forty men were employed for four months in gilding with pure gold the top of the Woolworth tower—one month less than the contract called for and at least eight months less than it would have taken to lay gold leaves on the old plan, even if that could have been done at all.

This work, which is so satisfactory to all concerned, was executed by the American Roll Gold Leaf Company, of Providence, Rhode Island.

A WORD FOR THE SCAFFOLDING

Nothing is more reasonable than to allow that contractors and builders generally would look to the safety and comfort of the men employed in the work of constructing a great building like the Woolworth.

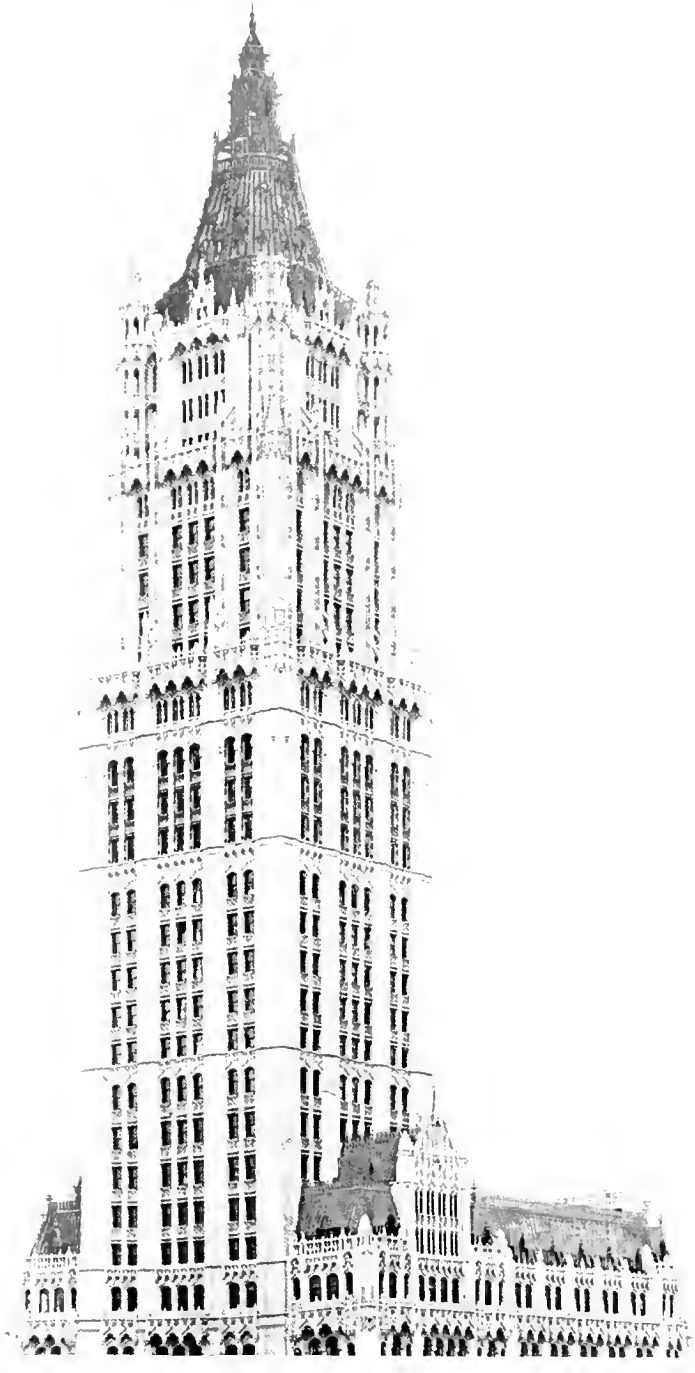
Scaffolding, whether for the fifth or the fiftieth floor, is an all important consideration, and only such as had been proved, beyond all question, to be absolutely safe and easily adjusted was taken into consideration by the general contractors for the Woolworth. The reputation of the builders of safe scaffolding also was carefully weighed. Finally, after incisive investigation, testing and examination, two manufacturers of scaffolding were chosen. These were the Patent Scaffolding Company, of New York City and Chicago, and the Chesebro-Whitman Company, of New York City.

The Patent Scaffolding Company installed mechanical appliances for the control of the suspended platforms upon which many lives depended in the exterior brick and iron work of the building.

When the great height of the building is contemplated in connection with the terrific wind of late fall and winter, when the scaffolding did its work, the superiority of the machinery and platforms will be understood. No accident occurred and not a life was lost. This is a praiseworthy reputation for the scaffolding of the Patent Scaffolding Company, which deservedly received the "Scientific American" gold medal, awarded by the American Museum of Safety, November 21, 1910.

The Chesebro-Whitman Company, of Sixty-fourth Street and First Avenue, New York City, built the scaffolds around the tower and mansard roofs when it was determined that these roofs and the tower should be decorated in gold. In this construction their men worked no less than eight hundred feet above Broadway, when vibration and elasticity against wind stresses were tested to the uttermost, but their work was accomplished in a masterly manner, and with their co-workers, the Patent Scaffolding Company, they could well boast of having no accident, or lives to mourn.

The hoisting, assembling and taking down of the scaffolding, after the building was occupied with tenants and hundreds of people were visiting the tower daily, was an arduous undertaking. Only expert and careful men could have accomplished the work without accident. This is only a fair statement and no fulsome praise, and is borne out by the fact that not a single complaint is on record.



GOLDLEAF ON ROOF AND TOWER—AMERICAN ROLL GOLD LEAF CO.

SUSPENDED PLATFORMS—PATENT SCAFFOLDING CO.

SCAFFOLDING—CHESEBRO-WHITMAN CO.

Scaffolding and its safety is all important in the construction of the great buildings of these modern days. Human lives and their safety are more worthy consideration than building construction, and neither owners, architects nor contractors can afford to jeopardize the men who make their ideals a realization. The firms which built the Woolworth scaffolding have gained a reputation they deserve for building safe scaffolding.

SELECTION OF THE ELEVATOR SYSTEM

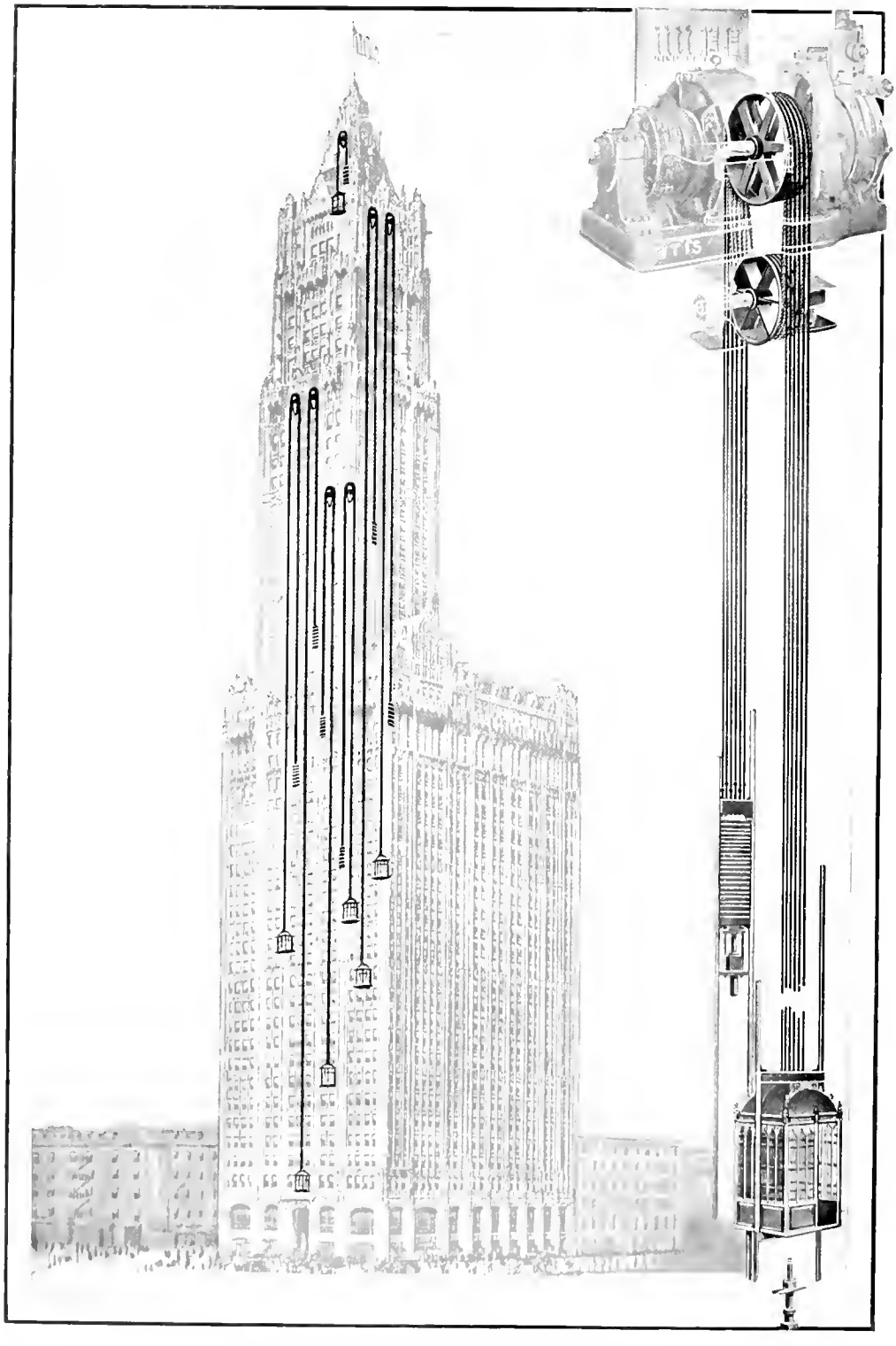
It was considered fitting that a building of such architectural excellence and completeness as the Woolworth should be provided with the most modern transportation facilities. With a view to selecting the best, all the different elevator systems in use were carefully investigated and tested, having in mind the extraordinary height of this building, as well as the many floors to be served. As a result of this investigation, in which safety, reliability, speed and simplicity were paramount to every other consideration, the contract for the entire equipment was awarded to the Otis Elevator Company of New York.

"Safety first" was the motto of the builders of this great structure, and in particular did this apply to the elevators. During the last few years accidents resulting in personal injury, due to faulty elevator mechanism, have been very rare. Nevertheless, every precaution was taken to make the Woolworth elevators absolutely safe. They were equipped with the most improved mechanical safety devices. All the shafts, too, were equipped with air cushions, which have been proved time and time again to be absolutely reliable. Not long ago, when severe tests were made, a car was allowed to fall from the twentieth story of the Empire Building in New York, and a basket of eggs which it contained was entirely uninjured when the car was checked in its downward flight by the air cushions.

To a very large extent the success of the modern high office building as a paying investment must depend upon its elevator service. Every floor must be readily accessible and must be reached in the shortest possible time. During business hours time is too valuable to be wasted in waiting long for an elevator, or in spending ten, or even five, minutes in reaching a floor which should be reached in as many seconds. This problem of quick service was very carefully studied and the elevator installation planned to give the best results.

INSTALLATION OF OTIS ELEVATORS

The elevator equipment, which is the most important part of the mechanical equipment of the building, consists of twenty-nine Otis Electric Elevators. Of these, twenty-seven are for the use of the public, seven serving the tower, and twenty the main building. In addition, there is an automatic push-button elevator for the private use of the Irving National Bank, and an ash lift which runs from the sub-basement to the sidewalk.



TWENTY-NINE OTIS ELECTRIC ELEVATORS

Of the seven elevators in the tower, two run to the fifty-third floor, two to the forty-seventh floor and two to the fortieth floor. These six elevators have a maximum capacity of 3000 pounds, and are designed to operate at a speed of 700 feet per minute with a load of 2500 pounds — the fastest service given by any electric passenger elevator in the world. One of the elevators which serves the fifty-fourth floor has an additional capacity of 6,000 pounds for lifting safes or other heavy loads. The seventh tower elevator is a shuttle elevator, which carries passengers from the fifty-third floor to the observation station of the tower and runs at a speed of 200 feet per minute with a load of 1500 pounds.

In the main part of the building, two of the elevators rise from the sub-basement to the twenty-seventh floor, twelve from the basement to the twenty-seventh floor, and four from the first floor to the twelfth floor. All are passenger elevators, with a maximum capacity of 3000 pounds, and are designed to operate at a speed of 600 feet per minute with a load of 2500 pounds. The other two main building elevators are combined passenger and freight machines which rise from the basement to the twenty-eighth floor, operating at a speed of 550 feet per minute with a load of 3000 pounds, or at a speed of 350 feet per minute with a load of 4000 pounds. These also have an additional capacity of 6000 pounds for lifting safes and other loads.

The two elevators serving the fifty-third floor travel to a height of 679 feet 6 inches, which is the highest travel by any single passenger elevator in existence.

SAFETY DEVICES ON ELEVATORS

All the elevators are equipped with a complete system of safety devices, and including air cushions which will bring the cars gradually to rest at the bottom of the hatchways, in case of a drop even from the top of the shaft.

As this was the first time that air cushions were to be used on elevators travelling fifty or more stories, every precaution was naturally taken to make them perfect. The air cushion being approximately one-fifth of the height of the shaft, it meant that the enclosure doors on the lower eleven floors of the high rise elevators would have to be heavy enough to withstand the air pressure developed in case the car fell from the top. As manual operation of these doors was out of the question on account of the weight, the architect asked the Burdett-Rowntree Manufacturing Company to solve the problem, believing that their broad experience in equipping all types and weights of sliding and lifting elevator doors with pneumatic operating devices would guarantee the successful solution.

Tests were made and a special pneumatic device manufactured, and the satisfactory manner in which all the one hundred and twenty-four air cushion doors are operating is evidence of good reasoning in selecting the Burdett-Rowntree Manufacturing Company for this part of the work. To reduce the cost of maintenance of the operating devices so far as possible, this company installed an automatic lubricating system whereby all the devices are lubricated through the medium of the air from one point.

LOWER BROADWAY AND THE BAY, FROM THE WOOLWORTH TOWER

The Architect desired that the Burdett-Rowntree Manufacturing Company should assume the responsibility for as much as possible of the working of the air cushion doors, and therefore, in addition to the pneumatic door operating devices, they manufactured and installed the special door hangers and adjustable interlock switches and hung all of the air cushion doors.

A unique system has been designed for dispatching the elevators and regulating the schedule and general service. The dispatcher is located in an isolated room, and by means of a position indicator is able to follow the progress of each elevator in the building. These indicators consist of a series of miniature lamps corresponding to the different floors served by each elevator, and as a car reaches a floor the fact is known to the dispatcher by the lighting of the corresponding lamp.

Automatic starting signals are placed at the terminal landings and a buzzer signal is fixed in each car.

In order that the dispatcher may communicate with the operator, telephones have been provided. These are so arranged that they may be operated from either end of the line, or from the dispatching room only.

The telephone instrument in the car is provided with a loud-speaking transmitter which magnifies the voice tones and enables the operator to receive telephoned instruction while the car is in operation.

The public signals consist of the Armstrong Full Flash Type, having the up and down lamps at each floor. In addition to these, for each group of elevators, there is an electric sign to indicate the character of the service,

whether express or local, and the floors which are being served. These signs are operated electrically and can be controlled and changed from the dispatcher's station.

Nothing has been spared to make this the most complete elevator installation in the world, and to give to the public and the tenants of the building the best elevator service possible.

ELEVATOR SIGNALS AND AUXILIARY DEVICES

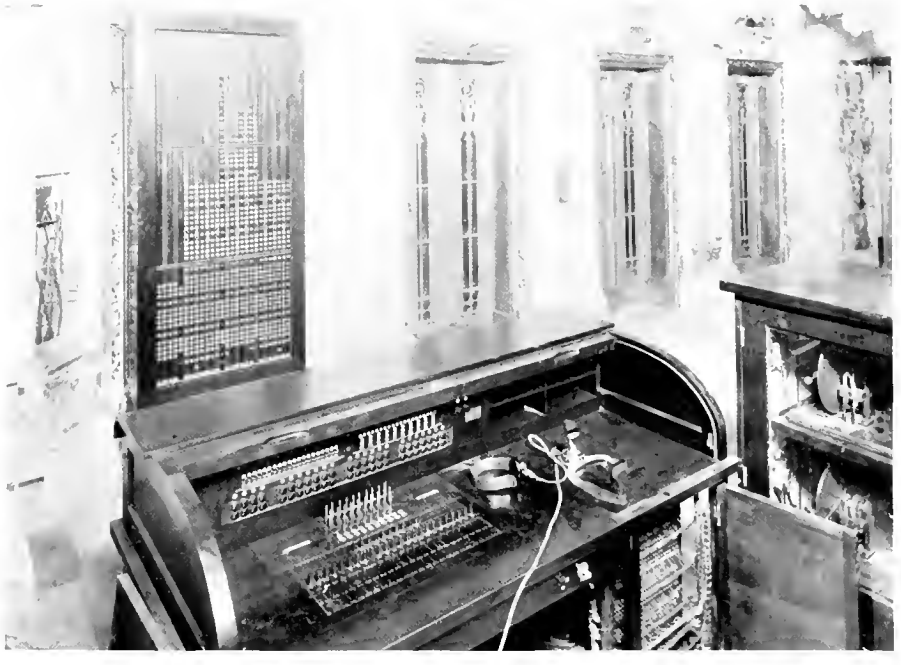
The large number of high-speed elevators in the Woolworth Building, while a fundamental necessity, by no means solve in themselves the problems involved; and they would fall far short of the duty demanded of them but for the elaborate system of elevator signals and auxiliary devices provided after careful study and experiment by the architect, consulting engineers and contractor.

The results attained are perfect elevator service, controlled from one central station instead of through several starters stationed at different points on the ground floor; efficient and economical operation of the elevators through the system of signals and signs whereby false stops are eliminated and delay in waiting for passengers at the floors is avoided; absolute safety to passengers ensured, whether entering or leaving the elevators, through the installation of the Norton device, which automatically closes and locks the doors and prevents all movement of the car until the door is closed.

The signals and various devices through which these results are accomplished may be mentioned briefly, as follows:

The passenger elevators, twenty-four in number, are equipped throughout with the Armstrong Flashlight Signal System, embracing the usual "Up Down" lanterns at the floors, through which the waiting passenger is directed promptly to the first approaching car; "Up Down" push buttons at the floors, whereby the operator is given timely signal to stop, and which signal is automatically carried to the next car in the event of his inability to stop by reason of a "full car" or other cause. Signals of special design are provided for two high-rise cars for night service. Directional signs are also provided, designating the travel of the elevators and showing plainly to the public their travel in respect to express or local service. The elevators are also equipped with illuminated "thresholds," a valuable factor of safety, inasmuch as the passenger is enabled to see clearly where he is stepping when entering the car and is not liable to stumble.

All the elevators are controlled, as has been mentioned, from one central station. This dispatcher's station is located on the main floor balcony and is provided with a Position Indicator Lamp Board, showing by miniature lamps the exact position of all the cars; a telephone system extending to all the cars and establishing communication between the dispatcher and operators at all times and regardless of the position of the car; motor-driven Automatic Timing Devices, ringing bells and buzzers at the top and bottom



DISPATCHER SYSTEM. ELEVATOR SUPPLY AND REPAIR CO.

of the elevator hatchways for starting the cars at predetermined intervals; motor generators, storage batteries, and equipment complete in every detail for the control of all the cars by one dispatcher.

In providing means for automatically starting the cars from either terminus and of transferring the signal to the next approaching car when the car originally signalled does not stop, and means whereby the dispatcher and his operators are in full communication at all times, the greatest source of delay in elevator service has been overcome.

The records of the liability companies show that eighty-five per cent. of all accidents to the public in connection with elevator service are what they classify as "door accidents," or those due to unlocked doors or which occur while the passengers are attempting to board or leave the elevators. The elevators in the Woolworth Building are equipped with the Norton Elevator Door Closer, a device that absolutely prevents the possibility of accidents of the class cited. With this device the door is opened manually by the operator in the usual manner, when released, it closes automatically, without noise, and locks. By an electric switch arrangement the controlling circuit of the elevator is broken while the door is open, and all motion of the car is automatically and positively prevented until the door is closed. Carelessness or confusion on the operator's part is thus rendered harmless to the safety of the passenger. The elevator signals and auxiliary devices herein described were furnished and installed by the Elevator Supply & Repair Company, of New York and Chicago.

THE PLUMBING FOR WATER SUPPLY AND DRAINAGE

The plumbing work, water supply and drainage system was installed by the W. G. Cornell Company, New York, Boston, Baltimore and Washington, and represents the most modern appliances and expert workmanship. There are approximately forty-three miles of pipe and two thousand plumbing fixtures in the building, and many novel but practical ideas were employed to make the water supply system and apparatus as substantial and useful as the building itself.

The rain-water drainage system is entirely separate from sewage drains, thereby preventing overflows and flooding of the building in case of stoppage of any of the pipes. A system of house supply tanks on different levels, each supplying a certain number of floors, equalizes the water pressure at the fixture outlets and prevents excessive pressure at any one point. The house supply tanks are located on the fourteenth, twenty-seventh, thirty-seventh, fifty-third and fifty-sixth floors and are in duplicate. The water-closets and urinals are supplied from the house tanks and pumps on a system entirely separate from the tanks and pumps which supply the other plumbing fixtures. There are separate water supply connections from the city mains in the streets on the three sides of the building; also a separate supply from the street direct to the fire-pump. This insures an ample supply of water at all times. In case any one or any two mains in the street are shut off by the Water Department there is still a plentiful supply of water. The total storage capacity of the thirteen tanks in the building is 88,000 gallons, all which is available in case of fire. The water in the swimming pool, about 42,000 gallons, is also available for fire purposes, having a connection from the fire-pump direct to the pool, which can be used in case of emergency.

A system of double water filters of ample size and capacity filters effectively all the water used. There are five water pumps to supply the house and fire tanks and, in addition, one 20x9x18 fire pump, which is guaranteed to deliver 500 gallons of water a minute at the topmost point of the tower, or approximately, eight hundred feet above the pump room.

Twelve hot-water heaters and their piping are so arranged as to divide the hot-water supply for plumbing fixtures into sections, thereby equalizing the pressure and flow at the faucets and insuring hot water in abundance at all times.

All the drain pipes are made of extra heavy galvanized wrought iron, with galvanized malleable, screwed, drainage fittings. The pump discharge pipes and fire standpipes are of extra heavy, galvanized, malleable hydraulic fittings. The hot-water piping and inaccessible cold-water supply piping is of annealed brass. The best materials were used because strength and durability as well as usefulness were the first considerations. A duplicate sewage and ejector plant, operated by compressed air, controls the plumbing fixtures, which are located below the level of the public sewer in the street.

Special arrangements allow for the expansion and contraction of all pipes and other unforeseen emergencies. Separate drains from the kitchen fixtures keep grease out of the general drainage system. There is a special arrangement of alarm bells to inform the engineers when the house tanks are empty or full. There are six fire-hose outlets, with 400 feet of hose and valve on each floor in the fire standpipe system. In the basement there is a large swimming pool, supplied with filtered water, showers and other up-to-date bathing appliances. There is a hot-water heater for pool duty alone and another one for the shower alone, thus insuring water at proper temperature for both. The bathing establishment has its own independent system of filters.

The plumbing fixtures are of "vitreous" ware and porcelain, and the toilet rooms are wainscoted with Carrara glass to a height of eight feet, so that the sanitary conditions are as nearly perfect as possible.

THE PIPES IN THE WATER SYSTEM

Under present day conditions of living there is no part of a building more important than the plumbing and water supply system. In fact there is nothing of equal importance, for in the final analysis, a building without a water and plumbing supply system is useless. In beauty and stateliness of design a building may express the highest order of genius in architecture; in strength and in appliances for safety and convenience it may represent the last word in the science of mechanical engineering; in construction it may be an example of the highest skill in all the crafts; but, it will stand a useless pile of brick and stone and iron entirely uninhabitable, without an adequate water and plumbing system.

The plumbing system in turn is dependent on the pipe which carries the water to and drains it from the system. Hence the quality of the pipe is of great importance. Pipe of inferior quality deteriorates quite rapidly and very soon becomes not only a cause of continual expense for repairs, but also, under some conditions, a menace to health. Therefore, those to whose skill and care were entrusted the designing and installing of the water and plumbing system for the Woolworth Building, having had a long and wide experience, were very particular in regard to pipe.

All the pipe was furnished by E. F. Keating Company, New York, and it is the best that can be made. It is strictly genuine wrought iron, all made from straight pig muck-bar, and all sizes larger than $1\frac{1}{4}$ inches were made lap-welded. All this pipe is galvanized. The soil, vent, leader and low pressure lines are of standard weight pipe, the high pressure lines of extra heavy. Before being delivered to the building, each and every length was subjected to a hydrostatic pressure, the standard to 1000 pounds and the extra heavy to 1500 pounds per square inch. After being cut, fitted and installed in position, it was again subjected to pressure tests. In the case of the stand pipes for fire protection, this test was at the greatest pressure which fire pumps could

develop; this forced the water through these stand pipes high above the top of the building, which is about 850 feet in height. Notwithstanding this series of very severe tests, not a single length of pipe gave way, not a joint leaked, and there are more than 40 miles of pipe.

While the foregoing brief description outlines what the pipe in the building is now, it is interesting to note that pipe of this quality furnished by the E. F. Keating Company thirty years ago is not only still in use to-day, but shows no signs of deterioration.

WELLS FOR WATER SUPPLY

Phillips & Worthington during the course of construction of the building drilled an 8-inch diameter well to a depth of 1538 feet below curb, and installed an 8-inch diameter driven or screen well in the water-bearing sand and gravel above the rock. This well is designed to serve a double purpose. It may be used for a water supply or to lower the ground water level at any time, thereby insuring a perfectly dry cellar.

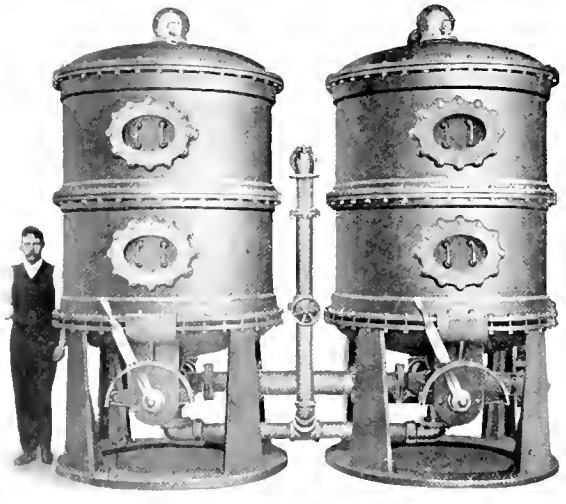
THE WATER FILTERS

The entire water supply of this great building is made clean and safe for all uses by Loomis-Manning Filters. The filter plant is divided into two or three parts, each supplying certain sections of the building. An unusual feature is the installation of two large filters to filter the wash water from the other filters of the plant. This cleansed wash water is discharged into a tank and used for flushing and other similar purposes. The swimming pool is provided with two large double cylinder filters to make the water attractive and safe.

The filters themselves, with the exception of those for filtering the wash water, are all of double cylinder type, providing double filtration and making it certain that the water shall not only be clean and safe, but free from any odor or taste that may be present in the "raw" water at any time. In construction the filters are the standard cast iron Loomis-Manning filters and are built in sections so that they may be easily taken apart for renewals or repairs, and may be readily handled in close quarters. The cast iron construction means that the life of the filters is the maximum.

Each filter cylinder is equipped with a solid bronze Manning Single Controlling Valve, so that it may be easily and accurately operated and controlled. The movement of the one lever operating this valve causes the filter to be flushed and cleansed from all the impurities that have accumulated and this is done with the greatest ease and the least waste of water on account of the accurate control and the sight glass on the waste line through which the cleansing process is watched.

These filters are built so that none of the filtering material can escape either with the filtered water into pumps, house lines, etc., or out through the waste when the filter is being washed. The filter beds are uniform grades



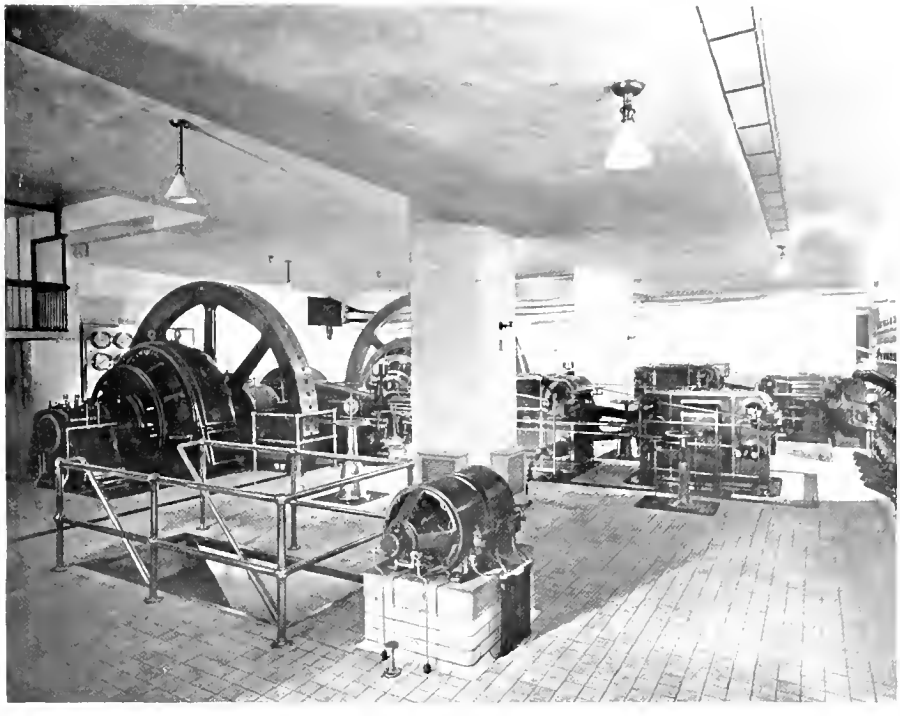
WATER FILTERS. LOOMIS-MANNING FILTER DISTRIBUTING CO., PHILADELPHIA

of specially selected and prepared material. Neither gravel nor other heavy substances are used, because they are too coarse and heavy to be properly washed. Each time the filters are washed the beds are agitated and cleansed from top to bottom, and consequently they are kept in efficient condition for long periods, often as long as eight, ten or twelve years with no renewals or replacements. The filter beds actually filter from top to bottom because the beds are of the same uniform grade throughout. All these points combine to produce a filter plant which is durable and lasting, is operated with the least expenditure of time and consumption of water for washing, and is thoroughly efficient in operation. In short, it is a plant which is in conformity with the high standard of this splendid building.

Regarding the value of clean, safe water in such a building, it is well to consider for a moment the expense that would be caused by mud gradually clogging pipes, if the water were unfiltered; the extra janitor force required to keep handsome plumbing fixtures bright and clean, if the water were dirty, the washers and faucets that would be cut if there were grit in the water; besides the extra cleaning and coal consumption caused by mud scale in the boilers. Undoubtedly, clean, safe water adds greatly in making a building attractive to tenants or prospective tenants. Moreover the filter plant of the Woolworth is a safeguard to the great mechanical and plumbing equipment of the building; it is a good "talking point" in renting the offices because it ensures the tenants water which they must delight in using.

THE ELECTRICAL ENERGY FOR LIGHTS AND ELEVATORS

The electrical energy for the lights, elevators and miscellaneous motors is furnished by two 5[illegible]-, one 3[illegible]- and one 2[illegible]-kilowatt direct current generators connected to four Rice & Sargent horizontal, tandem compound, non-condensing engines as designed and built by the Providence Engineering Works, Providence, R. I., the exhaust steam being used to heat the building during the heating season. The engines are of the Corliss or releasing gear type with unique valve gear construction. The wrist plate so common to the Corliss type of engine is dispensed with and a straight line motion substituted which operates the valves direct from the eccentrics.



RICE-SARGENT ENGINES—PROVIDENCE ENGINEERING WORKS

The engines operate on a combined power and lighting load without the medium of storage batteries, the flexibility of the governor and valve gear compensating for the large fluctuations in the load due to the elevators. An automatic safety stop motion, whose operation is independent of the governor, is provided and also arranged for electric control from remote stations to shut down the engines in case of emergency.

The engine foundations are isolated from each other and from the structural work of the main building. While the engines are in perfect balance this measure is a precautionary one only, and is done to eliminate all chances of vibration. Steam is supplied to the cylinders from below the floor, rendering unnecessary overhead piping with its accompanying disadvantages as well as disfigurement of the engine room.

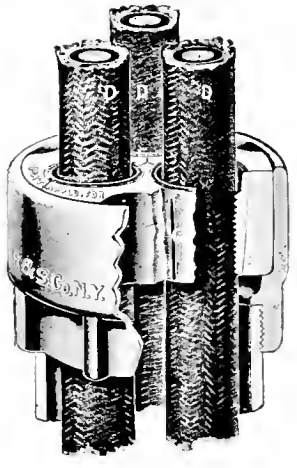
In a power plant of this kind reliability is the chief requisite, along with economy, efficiency, very close regulation and operation free from noise and vibration.

THE COPPER CABLE GRIPS

The cables of copper wires extending from the basement of the Woolworth Building to the top floor and wherever lighting is necessary were unusually heavy, and special fittings to hold them and allow of their being firmly held, or allowed to be carried along if necessary without the possibility of slipping, had to be designed and made specially.

The electric wiring was, of course, in proficient hands and when the necessity of special fittings which would grip the cable at will was evident, the situation was outlined to Russell & Stoll, designers and manufacturers of electrical fittings and fixtures, of Cliff Street, New York City.

After carefully studying the requirements they evolved a unique fitting which would either hold the cable firmly in its grasp or permit it to pass up or down as required. The following illustration will give some idea how the apparatus does its work.



A. The outer collar is screwed to the pipe instead of an outlet bushing.

B. This point shows the inserts adapted to the number of cables to be used.

C. The slit tapered sleeves which grip the cable D.

D. The cable.

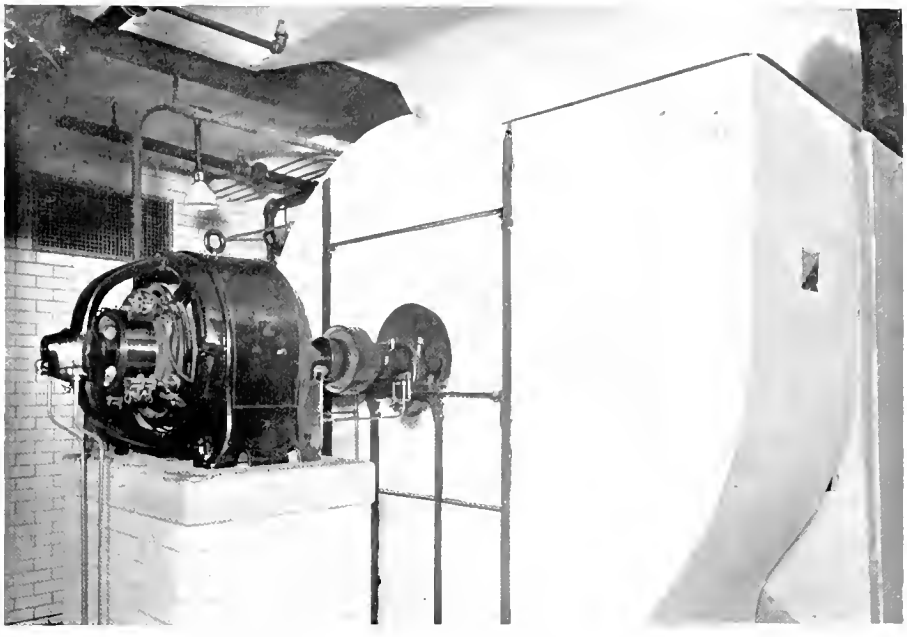
As will be seen in the illustration, the outer collar of the support is screwed to the pipe, instead of an outlet bushing as in other cable supports; also that the inserts are adapted to the number of cables to be used. Another important feature is the split tapered sleeve which grips the cable. The great advantage of the fitting is its simple construction. It cannot get out of order and contractors can install it without extra cost.

THE HEATING AND VENTILATION

The heating and ventilating plant in the Woolworth Building was built in accordance with plans and specifications prepared by the well-known firm of consulting engineers, Nygren, Tenny & Ohmes. Heating and ventilation is their special field of work, and the unusual requirements of the great Woolworth Building made special demands upon their resources and skill. Their plans were undoubtedly made with great care and precision, and executed under their supervision to the entire satisfaction of architect, contractors, owners and all interested.

There are nineteen C & C electric motors installed in the building, directly connected with the fans. The motors were specially built for the Woolworth, and a most important feature is that both the motors and the entire apparatus connected with them are absolutely noiseless in action. It must be conceded that "quiet" is as essential in business offices as ventilation.

The electric motor made possible and practicable the installation of blowers and fans in a number of locations throughout the building up to the forty-sixth floor, and these are doing excellent work in supplying fresh air to the building every day of the year; and notwithstanding the number of fittings and accessories the work is done silently. Like all good human workers they do their work well and make no noise about it.



VENTILATING SYSTEM—C. & C. ELECTRIC & MANUFACTURING CO.

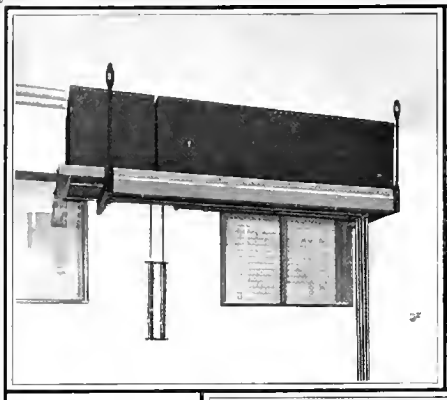
It is only fair to say that ever since the inception of mechanical ventilation, the C & C motors have been identified with every advance made by steam heating engineers in work of this character.

The earliest installations of types of motors originally applied to fans and blowers, as the "Commuted Field" and "Armature Control," have been succeeded by the "All Field Control" motors, the type installed in the Woolworth Building. These are manufactured by the C & C Electric and Manufacturing Company, of Garwood, N. J. They represent the most reliable and economical design for the purpose of driving fans and blowers in connection with indirect heating systems.

BOWSER SYSTEM OF OIL FILTERING AND CIRCULATING

In asking S. F. Bowser & Company, of Fort Wayne, Indiana, to design their oiling system, the builders of the Woolworth recognized that they were experts on the question of lubrication, and understood that the successful bidders must design and erect a system which they knew to be efficient; that not only one engine, but the entire plant, must automatically and exactly be given the oil it requires, and at the same time be free from complicated mechanism which would necessarily involve a great deal of mechanical supervision.

To meet these specifications a complete "Bowser" Gravity Oil Filtering and Circulating System was installed. All engine and cylinder oils are fed to moving parts in quantities large enough to reduce friction to the minimum, and at the same time to collect, purify and return the oil so that it can be



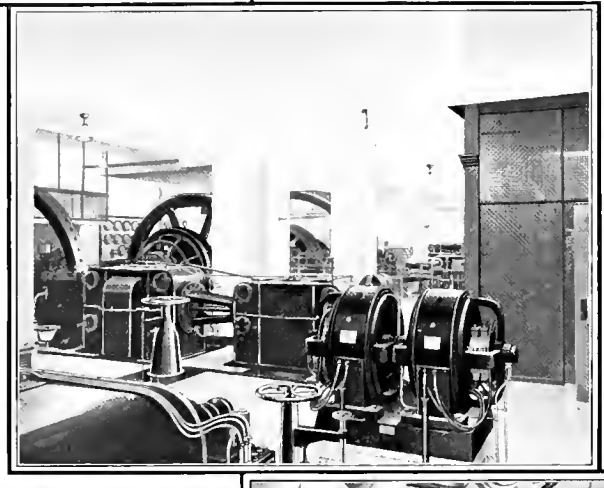
THE BOWSER GRAVITY TANKS

Illustration to the left shows the Bowser overhead gravity tanks fitted with wall indicators and equipped with high and low level electrically operated alarms. The oil is automatically controlled by a pump governor to any level.

These overhead tanks have sufficient capacity to keep an entire plant supplied with oil for eight hours' time.

View at the right of engine room showing method of concealed piping. Not a drop of oil is wasted and the friction is cut down to the minimum. Every working part of the machinery is flushed with oil—no part is neglected.

A Bowser system of the proper size will pay for itself in its saving of oil alone, in a comparatively very few months' time and its upkeep is negligible.

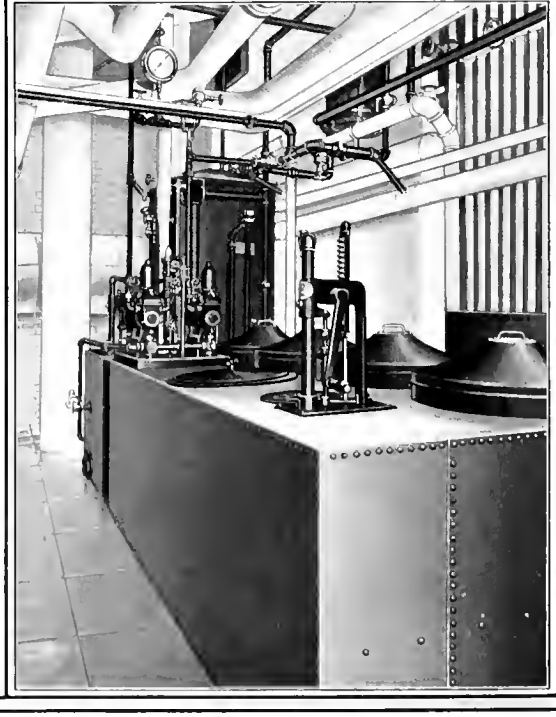


THE BOWSER 2 F 4 FILTER

The Bowser Filter is placed in the basement below the lowest bearing so that the oil will run to the filter by gravity.

First the oil is heated and separated from the entrained water, which is ejected automatically, then the oil passes over a series of precipitating pans through the filter section and is stored ready for use.

It is recognized by the highest engineering authorities that the squirt-can-oil-hole method is antiquated, wasteful, disastrously insufficient in supplying lubricant and in its insufficiency causes shut downs and delays.



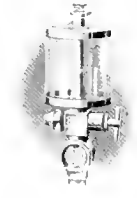
used over and over again without loss and without injury to the finest and most delicate machinery. Covered by the "Bowser" Engine Oil Lubricating System, there are four cross-compound engines, four balancer sets, one refrigerating machine and nine ventilating fans. The cylinder oil system, besides the engine and refrigerating machinery, takes care of 24 pumps.

The 2 F 4 "Bowser" Oiling System used is a regular, standard gravity outfit designed to purify 80 gallons of used oil per hour. This system consists of a separator equipped with automatic water discharge, drip tank equipped with four filter sections, each section having 55 square feet of filtering surface, or a combined filtering surface of 220 square feet. The overhead gravity tank for engine oil, having a storage capacity of 400 gallons, is equipped with wall indicator connected to high and low level alarm, oil level in this tank being controlled by duplicate steam pumps fitted with automatic governors.

THREE-BOWL OIL FOUNTAIN

The cylinder oil system consists of an overhead gravity tank, equipped with float control, etc. The cylinder oil system automatically cares for the ice machine, four cross-compound engines, and complete equipment of pumps.

There is not a tee, elbow, or cross in any of the drip or return lines in the entire installation, all connections being made with long bends and ground joint unions, all piping terminating in accessible drip manifolds so that a cleaning cable can be passed to any line or branch.



BULL'S-EYE OIL CUP

All main branches to oil feeders are nickel-plated copper tubing, and connections are made with "Bowser" swedge unions and will never leak. The piping on the engine oil system alone involves more than 2000 feet. There are four two-bowl oil fountains, 50 complete oil cup bases and a large number of other special fittings.

HEADER FITTING

The oil is received through special fill boxes, stored in "Bowser" tanks, filtered in "Bowser" systems, pumped with "Bowser" pumps to "Bowser" gravity tanks, and fed to all moving parts by "Bowser" fittings. The price includes every item, every fitting, every detail, ready to go to work to save money when you contract for a "Bowser" system.

DUNHAM SYSTEM OF VACUUM STEAM HEATING

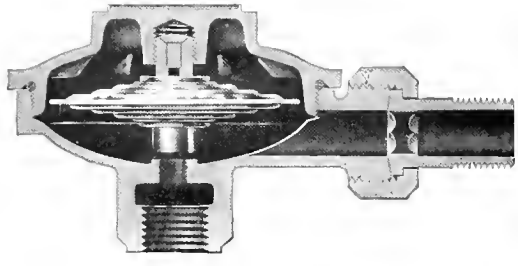
The architectural grandeur of any building designed for human occupancy would count as naught were careful consideration not given to the more homely details of construction that contribute to that great and powerful element of human desire—personal comfort.

Imagine, if you can, a structure such as the Woolworth Building with all of its pleasing effects of architecture, without some means of providing artificial heat in its many rooms during the winter time. Under such conditions the marble hallways, the artistic chandeliers, and the polished fur-

nishings would absolutely lose their charm, and the occupants of the rooms would forget the mission of them in the desire for a more practical deliverer of real satisfaction—good heat. It's human nature to stand with comparatively good grace anything displeasing to the sense of sight, but to become impatient instantly when the delicate sense of feeling is disturbed.

The builders of the Woolworth Building observed and heeded this quality of human nature and placed in their building, in addition to beautiful forms and magnificent decorations, a heating system that has no peer in the field today.

It uses steam as the heating medium and circulates it by means of the well known vacuum principle with devices manufactured by the C. A. Dunham Company, of Marshalltown, Iowa. In the heating profession the system is known as the Dunham System of Vacuum Steam Heating.

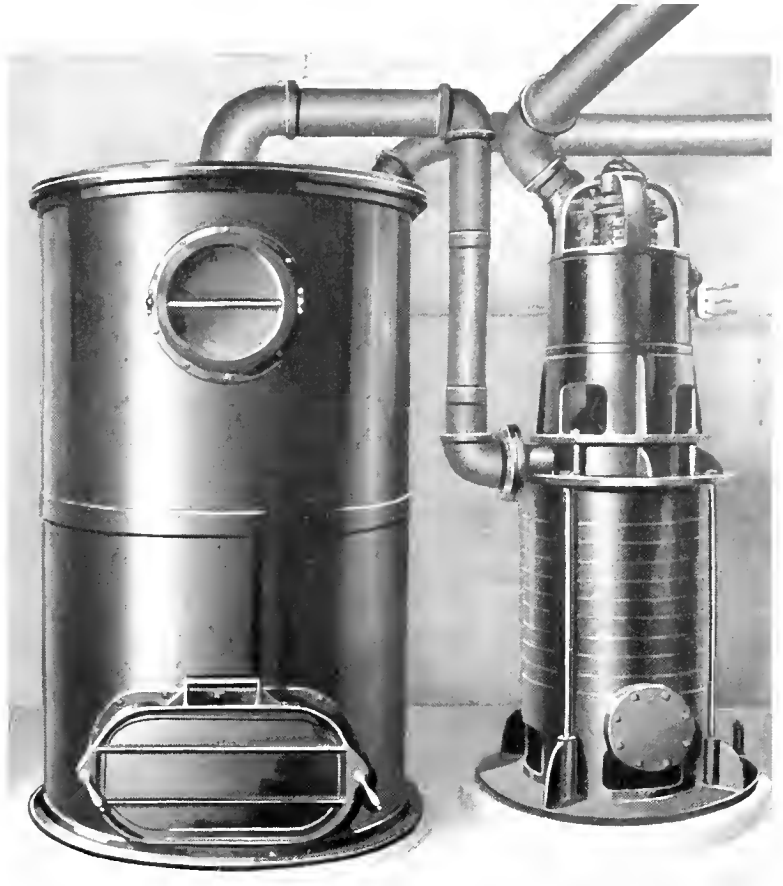


It consists essentially of a source of steam supply, a steam distributing system that carries the steam to the radiators, a Dunham radiator trap which drains each radiator of all water of condensation and air without loss of steam, a system of return piping which carries away the water and air discharged by the trap, and a system of pumps which performs the threefold function of producing a suction upon the return piping, eliminating the air from the system and forcing the water of condensation back into the boilers for re-evaporation.

The Woolworth Building by reason of its tremendous height presented several rather unique heating problems. One was to procure even distribution of heat in the highest stories, and another was to properly care for the expansion of the piping that carried the steam to these remote floors. Both of these problems were met successfully by the adoption of a system of heating that applies the vacuum principle of induced circulation. Steam is circulated into the farthest radiator quickly and without any attending noise.

The distinguishing feature of the system is the small radiator trap that connects between the bottom of each radiator and the return line. (See section cut herewith.) This little trap conserves the steam that enters the radiator and at the same time keeps the radiator free from water of condensation and air. Since the most common cause of noise in a system of heating is the accumulation of water and air in the radiator, the importance and worth of this little device are quickly seen.

The heating department of Thompson-Starrett Company installed the heating system for this building, and the proper design, selection of materials and installation can be accredited to Wm. Gordon, Manager of the Heating Department of Thompson-Starrett Co.; J. E. Eden, Architect's Engineer, and Messrs. Nygren, Tenny & Ohmes, Consulting Engineers.



VACUUM CLEANER SYSTEM—SPENCER TURBINE CLEANER CO.

THE VACUUM CLEANING SYSTEM

The Vacuum Cleaner System installed in the Woolworth Building consists of a turbine air exhauster and auxiliary dirt-receiving tank in the basement and the piping system which runs up through the building to the top. Inlet valves with spring covers, which automatically close when the hose is removed, are assembled in the piping system at each floor, so that the light and flexible vacuum cleaning hose can be quickly and easily attached to these inlet valves for cleaning purposes.

The heart of the system is the vertical turbine air pump, which is direct driven by an electric motor mounted on top of the turbine. The machine is extremely simple and durable in construction, and the moving element consists of a vertical steel shaft on which is mounted a series of steel impellers or fans, and there is a clearance of approximately $\frac{3}{16}$ inch between the moving and stationary elements which come in contact only at the ball bearings.

In exhausting the air the end thrust of the moving element of the turbine is upward, and this is almost exactly counterbalanced by the weight, so that in reality there is practically no thrust or strain up, down or sideways, which makes a very simple and efficient arrangement.

The dust and dirt and litter, such as cigar and cigarette stumps, are sucked down through the piping system to the large auxiliary dirt-receiving tank, where this foreign matter is centrifugally separated from the air. The vitiated air is then carried completely out of the building through the smoke-stack, and the cleaning operation conforms to hygienic laws throughout.

Owing to the constant potential given by a turbine type of air exhauster, the vacuum is always maintained practically constant, whether only one or the full number of sweepers is in operation, and the power consumption is in proportion to the work being done. The advantage of this constant potential feature of the air turbine is that after designing and building a machine to give the proper vacuum so that the suction is strong enough to do thorough and rapid cleaning and not strong enough to injure carpets or rugs, this suction does not vary at the cleaning tool, whether one or more sweepers are in use.

Among the advantages claimed for this type of vacuum cleaner are that it requires no wet separating tanks, no sewer connections and, being direct driven, it requires no belts, gears, or chains with their resultant noise and trouble. Neither does it require any mufflers, sight-feed oil cups, valves or valve seats.

The vacuum cleaning system in the Woolworth Building was installed by the Spencer Turbine Cleaner Company, of Hartford, Conn., whose New York office and demonstrating room is at 1182 Broadway.

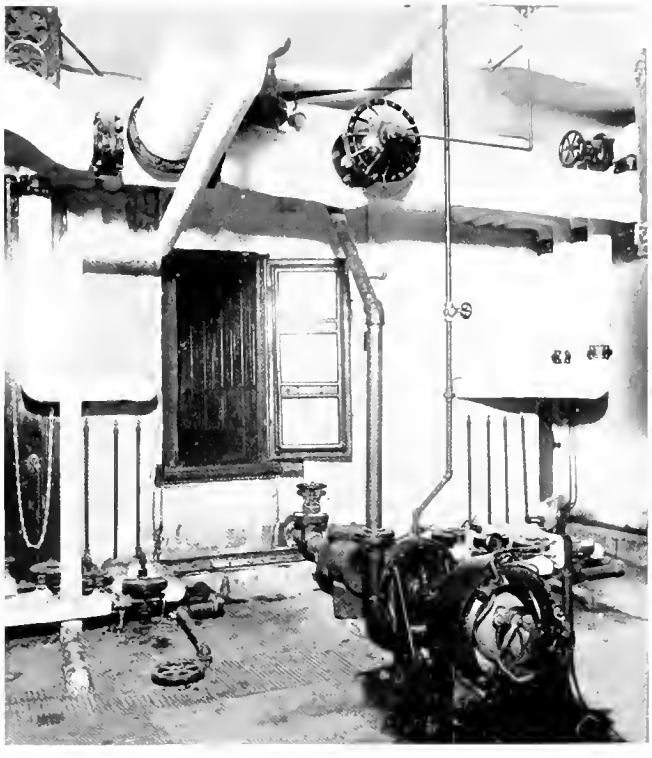
PREPARED FOR FIRE

Although it would seem impossible that a fire should ever occur in a building constructed altogether of non-flammable materials, it sometimes happens that tenants accidentally set fire to their papers or anything else of an inflammable nature which is in their particular office. To provide adequately for such emergencies six standpipes, each six inches in diameter, are located conveniently in the stair, towers and corridors. They are so arranged that any point of any floor may be reached with a 75-foot length of hose pipe, which has a 1-inch standard nozzle.

Four of the standpipes are located on the thirtieth floor, one on the thirty-fourth floor and one continued to the top of the tower, but hose connections to them are on every floor.

Upon the roof of the main building Siamese hose connections are placed, one to each riser, and these continue up to each wing.

Supply tanks of 0,200 gallons capacity are located on the fourteenth floor, three tanks of 2,500 gallons capacity on the twenty-sixth floor, 3,100 gallons on the thirty-seventh floor, 0,000 gallons on the fiftieth floor, and 1,200 gallons on the fifty-third floor.



"KINEALY" AIR WASHERS
KAUFFMAN HEATING AND ENGINEERING CO

PURIFYING THE AIR

The forethought of the owner and builders of the Woolworth on behalf of tenants and their comfort and health cannot well be overestimated. Progenitors of new buildings in the future will find great difficulty in conceiving new ways of winning the paying approval of prospective tenants. Think of ensuring pure air in modern office buildings during the humid summer months, when breezes are rare, and again, in the months of frost and snow, when heaters generally take the vitality from the atmosphere, and to obtain pure air it has been necessary to risk a season of grip or influenza. The upper rooms of the Woolworth Building are revelling in pure air. Ventilators may modify the temperature at will, and radiators are arranged to warm without destroying the life-giving qualities of oxygen and hydrogen. The rooms below the surface of Broadway, Park Place and Barclay Street, where Boreas never enters—neither does a mild breeze—also have pure air in abundance. Fans are excellent and make life pleasant sometimes, but they do not meet all requirements, especially in winter.

The Kauffman Heating and Engineering Company has met the difficulty in the Woolworth Building, and the rathskeller, engine room, barber shop and banking rooms are receiving purified "washed" air through the "Kinealy"

air washers which this company has installed. The "Kinealy" air washers purify and cool all the air delivered wherever installed.

The air is first received from the outside, drawn through water, discharged into the air in an atomized condition through "Kinealy" patented spray heads, and then drawn into what are called "eliminator" plates, which separate the air from the water. After leaving the eliminator plates, the air is free from all entrained moisture and delivered to the rooms; in the winter time heating and purifying, and in the summer cooling and purifying.

During the summer the air in the different rooms is cooled to about twenty degrees below the outside temperature. The air is also delivered into the rooms with the proper percentage of humidity, which makes the rooms habitable. The water used in connection with this apparatus is recirculated by centrifugal pumps, which make the apparatus inexpensive in operation as regards the water consumption.

The "Kinealy" apparatus was selected by the engineers and architects after rigid inspection and tests.

By the use of the "Kinealy" air purifiers the engineers were able to supply the upper rooms with purified air; otherwise it would have been impossible to install a perfect ventilating system in the building, owing to the great amount of dust and foreign particles discharged into the rooms through the fans

THE STONE BEDS FOR MOTOR PUMPS, ETC.

To eliminate all possibilities of vibration from the massive motor pumps, ventilators and other machinery with which the Woolworth Building is equipped the architect specified a solid even stone foundation. This important detail of the construction demanded special attention owing to the gigantic proportions of the building and the consequent massiveness of the machinery and the resulting vibration.

The advantages of a stone foundation for machinery, separate and distinct from the building foundations, being universally recognized, the only consideration was the choice of the contractor. To John Best, of 414 East Ninety-second Street, New York City, was awarded the contract not only because this firm had the most extensive facilities for handling so large a contract but for the quality of the stone this firm is in a position to supply.

The contract called for approximately 250 caps for the motors, pumps, ventilators, fans and other machinery. The largest of these caps or stone beds was thirteen feet three inches by four feet three inches by six inches; the total number of holes bored was six hundred. Caps were also supplied to hold the machinery in place. Mr. Best had the huge blocks of stone brought from the Portageville quarries in New York State. The stone beds were built and no holes had to be rebored. The work was highly satisfactory and the stone beds are as firm as the foundation of the building itself.

CAMIA REFLECTOR—GLEASON-TIEBOUT GLASS CO

THE LIGHTING GLASSWARE

One of the difficulties which confronted the architects and contractors in charge of the construction of the Woolworth Building was the selection of the lighting glassware. Practically every glass manufacturer in the country submitted samples of products in the hope of securing the contract. The most careful investigation of the respective merits of all the glasses submitted was eventually made, and it was decided that the Camia reflector, manufactured by the Gleason-Tiebout Glass Company, of Brooklyn, N. Y., was best adapted for the work in hand. Bowl type 100-watt reflectors, mounted on suitable lighting fixtures, are used throughout the building.

Camia glass is recognized as being the most beautiful white glass produced by the glass chemist. Snow-white in color, its density is sufficiently great to entirely conceal the filament of the lamp, so that none of the direct rays of light strike into the eye. Used with bowl frosted lamps, glare is absolutely annulled. At the same time Camia is an economical glass to use for the reason that only about ten per cent. of the light transmitted through it is absorbed. The inner surface of Camia glass is "depolished," thereby producing a perfectly diffused light, soft and comforting to the eye, even when the lighting unit is directly in the field of vision. Camia glass is blown in all shapes and sizes from the simpler units, adapted for commercial purposes, to the most elaborately shaped semi-indirect lighting bowls and urns, intended for use in the most costly edifices or amid luxurious surroundings.

ARTISTIC LIGHTING FIXTURES

It is often the details that make evident the artist. The selection of the lighting fixtures occasioned no little study, as the desire was to make the building and all of its infinite details a complete artistic whole. Edward F. Caldwell & Company, of New York, were selected to furnish the entire building, and those who delight in true excellence in art metal work will appreciate their efforts in this wonderful structure. This company supplied electroliers, candelabra, sidelights, brackets and numerous other fixtures, each one a thing of beauty in itself and bearing the stamp of the artist in design and finish.

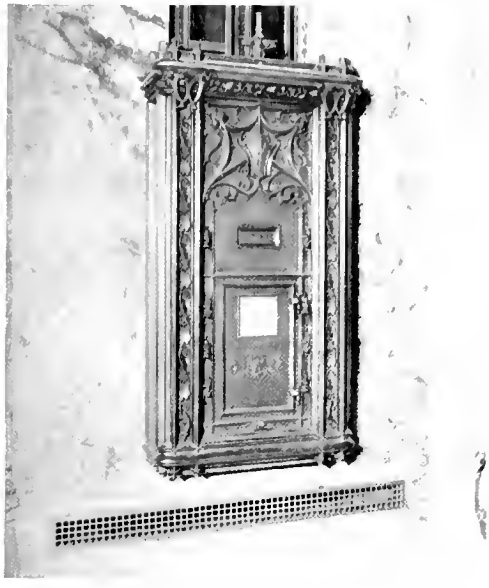
LIGHTING FIXTURES
EDWARD F. CALDWELL & CO.

Some of the fixtures in the more prominent parts of the building are replicas of rare ancient works in art metal, although most of the designs and executions are original with the house that furnished them. In the more elaborate fixtures designed for the ceilings of halls and corridors and the Irving National Bank quarters, the artist of the Caldwell Company attempted to harmonize the design and finish with the architectural decorations surrounding it. Through all the designs the observer feels a constant striving for simplicity, showing commendable self-restraint on the part of the artist.

The character of the designs of the principal fittings, as in the main hall and the Irving National Bank, is Gothic, carrying out the decorative scheme of the building.

THE CUTLER MAIL CHUTES

Some years ago, when the new Post-Office building at Washington, D. C., was nearing completion, the question of mail chutes versus letter boxes in each story, for the convenience of the various bureaus, was discussed and decided in favor of separate mail boxes on the score of economy. Fourteen boxes were installed in the seven stories, but it was soon discovered that the time spent in collecting the mail from these boxes delayed the mail very considerably, and it was then determined to adopt the Cutler Mailing System. The boxes were removed and two mail chutes installed, providing fourteen points at which the mail is deposited, but requiring collection from only two boxes at the post-office level, instead of from fourteen distributed throughout the building.



MAIL CHUTE SYSTEM—CUTLER MAIL CHUTE CO.

Had there been any method of handling the outgoing mail of a building superior to the Cutler system, Mr. Cass Gilbert would probably have taken it into serious consideration, but after careful investigation he concluded that experience has shown not only that Cutler mail chutes are efficient and reliable, but that they afford the only method by which modern mail collection service can be supplied to a commercial building.

Notwithstanding the unusual number of floors and offices, the Cutler mail chute for the tallest building in the world was neither especially designed nor constructed, but the type known as Model F, in which the front panels are removable on occasion by a post-office official, but by no other person, was adopted.

All the exposed parts of the mail chutes are covered with heavy sheet bronze, it being found impracticable to manufacture the chutes of this material, special rolled steel being necessary and the bronze covering being applied in order to conform the mail chute work to the elegant surroundings.

Four immense mail boxes for receiving letters in the main corridors were designed by the architect and are harmonious with the general ornamental character of the marble carving and decorations.

The mail chutes in the Woolworth Building are really an extension of the mail boxes to the upper floors of the building, and for this purpose two hundred and two stories of mail chutes have been installed. They consist of a heavy steel channel with its entire front of heavy plate glass, the front panel set in frames of drawn bronze reinforced by steel angles which give great strength and rigidity. These panels are removable by the use of a key exclusively in the hands of the local postmaster, so that the interior of the mail chute is accessible upon occasion to the post-office representative, and to no other person.

The post-office requirements are, of course, fully complied with in the mail chutes of the Woolworth Building, and the mailing openings are controlled by a closing device which, when operated by the post-office official,

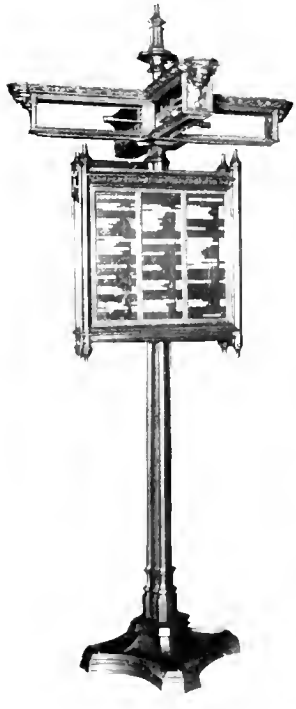
brings a metal stop with the word "closed" up in front of the mailing aperture, holding it there securely and preventing the introduction of mail matter into the chute until released by the use of the key.

Special deflecting devices are used in the mail boxes, and a special door is placed in the top of each box so that in the event of any accidental stoppage, access may be had by the post-office official at the point at which the chutes discharge into the boxes.

This installation is the most important ever made by the Cutler Mail Chute Company and should be examined by architects and others interested.

THE MODERN OFFICE BUILDING DIRECTORY

Old things have all passed away and all things have become new. Daily are we reminded of the ideals of a century ago, or half a century ago, or perhaps only a quarter of a century, and the comparison with what we see around us to-day is at first startling; then when we realize the grandeur of invention and cultivation which is unostentatiously demonstrated in the marvelous advance, we are delighted to realize that we are living in an age of scientific progress and consequent intelligence. The development of electricity, wire and wireless, and building construction, with the equal development of accessories, appliances and minor details during the past twenty-five years alone, is sufficient to thrill the hearts of all the rising generation, as well as those who have outlived their little span of life, but have lived to see the marvels of the twentieth century. It is small wonder that the old "name-board" which was an "eyesore" in the old style office buildings has been replaced by "directories" artistically framed in iron frames, designed and bronzed in harmony with the building.



DIRECTORY SERVICE
TABLET AND TICKET CO.

The Willson Directory System for tenants, installed by the Tablet and Ticket Company of New York, was just the one thing needed to complete the most conspicuous building in the city. Not alone is it admirable for its compactness, utility and beauty, but because it can be easily controlled with unfailing regularity. The day the tenant signs the lease the name is recorded in the directory and desired changes are made immediately notice has been given to the superintendent of the

building or one of his assistants. Every name is alphabetically arranged, the name being made with white letters on black strips, which are more durable and more effective than the reverse.

The directory is composed of a number of specially constructed frames fitted in the bronze standard (see cut). Within these frames are sheets of plate glass with beveled edges, so arranged that the strips on which the names are placed may be inserted or removed at will without changing the alignment or affecting the directory in any way.

THE ADOPTION OF AWNINGS

Awnings have not been common on the windows of office buildings. The piercing rays of the sun on a July or August day, high up above the buildings roundabout, necessitated some reliable protection, and since the friendly awning will permit the cooling breezes to blow in while it shades the occupant of the room, it was thoughtfully adopted.

The important consideration was to have wrought iron frames built strong enough to resist the wind pressure, even to the fiftieth story and above, but this was a matter of design and specification together with the color and texture of the cloth. Everything, even to the shade of the cloth for the awnings of the Woolworth Building, was to be in harmony.

No doubt the architect had remembered the gay and beautiful awnings of Italian homes and hotels, and those of Spain and other countries where the rays of the sun are not productive of comfort on a midsummer day; anyhow his knowledge even about awnings proved to be equal to the requirements of the building and the delight of prospective tenants

The shape and strength of the frames was demanded by the tremendous wind pressure which would certainly be met with, but the matter of cloth, what its texture, shade and color were to be the artist had to decide.

Whether the architect selected the cloth for the awnings which adorn the Woolworth from the viewpoint of a well studied color scheme or the tenants' comfort and convenience, is not on record, but undoubtedly the tan color stripe harmonizes with the color scheme of the building, and what is of equal importance, it will not fade or change by rain or atmospheric action

The cloth is the best that can be manufactured, and John Boyle and Company, Inc., the manufacturers, are to be congratulated for their success in supplying such excellent material, which certainly cannot be excelled for its lasting quality and general suitability.

PRESIDENT'S ROOM—IRVING NATIONAL BANK

In many respects the Irving National Bank is responsible for the existence of the Woolworth Building. It was in reality the problem of finding a suitable home for the bank that first gave Mr. Woolworth the idea of a building, part of which would be occupied by the Irving National Bank.

The Irving National Bank was organized in 1851, and was known originally as the New York Exchange Bank. It was the first of the state banks of New York City to apply for a national bank charter when the National Bank Act went into effect, its charter number being 345.

When organized, the New York Exchange Bank had a capital of $150,000, and was located in the basement of the North River Bank Building, where it remained for ten years. When the bank entered the national system, in 1864, it moved into the Merchants' Exchange Building and remained there until 1870, when it secured a lease for quarters in a building at College Place and Chambers Street. The lease was purchased from the Hudson River Railroad Company and a new building erected.

From its organization until 1898 the management remained practically unchanged. In that year Lewis E. Pierson became Cashier and shortly thereafter achieved the Presidency. The progressive policy inaugurated by Mr. Pierson gave the bank new impetus and it was largely through his efforts

that the resources of the bank began to increase gradually from $2,05[illegible] in 1898 to approximately $5[illegible], which it reached at about the time of Mr. Pierson's retirement.

In September, 1904, the capital was increased to $5[illegible], and further increased to $1,000,000 in March, 1905. In February, 1907, the New York National Exchange and the Irving National consolidated, under the name of the Irving National Exchange Bank, the capital was increased to $2,[illegible] and the surplus to $1,000,000, with total assets of about $24,[illegible].

During the period of financial unrest in 1907, the customers' transactions with the Irving were handled in a normal manner, including full currency payments for payroll and other counter purposes, with liberal shipments to correspondents, the continuance of immediate credit for all country checks, and the granting of regular loans and additional accommodation.

In January, 1909, the assets of the bank reached $29,[illegible]; in 1910, $31,500,000, and in 1911, $33,3[illegible].

In January, 1912, the resources crossed the thirty-four million dollar mark. After having faithfully studied the problem of providing adequate quarters for the increasing business of the bank, the Board of Directors finally accepted an offer from Mr. F. W. Woolworth, which provided for rental by the bank of ample space in the mammoth fifty-seven story Woolworth Building, which was then in course of construction.

In May, 1912, the Irving National Exchange and Mercantile National Bank were merged, under the name of the Irving National Bank, with a capital of $4,000,000; and a surplus of $3,000,000; total resources of about $50,000,000.

The Irving National Bank is one of the leading commercial institutions of the country; its directorate is composed of active and successful business men, and its growth has always been along strictly commercial lines.

COMPARATIVE GROWTH

	Capital	Surplus and Profits	Deposits	Assets
1898	$ 300,000	$ 53,400	$ 2,045,000	$ 2,051,700
1904	500,000	339,800	4,400,000	5,500,0[illegible]
1908	1,000,000	886,300	5,850,3[illegible]	8,241,0[illegible]
1907	2,000,000	1,000,000	20,437,3[illegible]	24,880,1[illegible]
1910	2,000,000	1,643,1[illegible]	27,521,7[illegible]	32,227,[illegible]
1913	4,000,000	3,382,074	42,383,000	52,803,715

The Seal of the IRVING NATIONAL BANK B/L NEW YORK *Irving National Bank*

VAULT EQUIPMENT AND STEEL OFFICE FIXTURES- CANTON ART METAL CO

THE VAULT EQUIPMENT OF THE IRVING BANK AND BROADWAY TRUST COMPANY

The admirable vault equipment and the steel filing cases and steel omnibuses used by the Irving National Bank and Broadway Trust Company located in the Woolworth Building, were manufactured by the famous Canton Art Metal Company, of Canton, Ohio

In modern banks and offices steel furniture and filing devices have become an absolute necessity. Steel is adaptable to the various forms and sizes most useful in office appliances, and when well designed, made and artistically finished, they are immeasurably useful as well as highly ornamental. Then fire-resisting qualities and economy generally are also worthy of careful consideration.

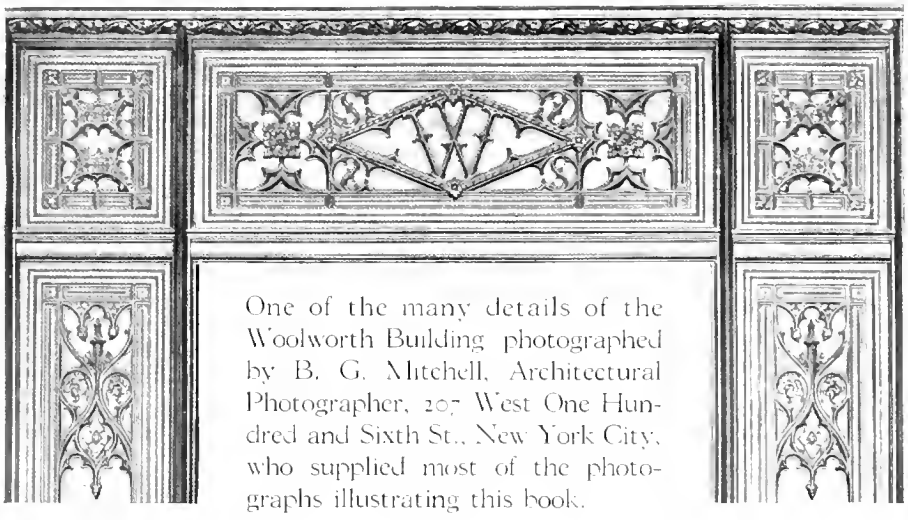
The managers of the Irving National Bank and Broadway Trust Company are well satisfied with the equipment specially made for them by the Canton Art Metal Company, which manufactures in steel almost everything useful in a thoroughly up-to-date office building, including steel desks, tables, counters, chairs and filing devices of every form and size necessary. These are not solid, clumsy fixtures, but made from light sheets of rolled steel,

shaped by powerful machinery to all the necessary curves and forms, and then finished as carefully as if they were pieces of jewelry, and bronzed or otherwise made ornamental.

The equipments made by the Canton Art Metal Company are known in many parts of the world. Public offices, banks, libraries, office buildings, and many private residences are absolutely secure against fire when unburnable material is used as receptacles for inflammable documents.

The architect who is alert to clients' interests long ago discovered the great advantages as a safeguard, and on the score of economy and cleanliness, of metal devices and steel furniture for the office and library. Steel furniture never wears out and vermin cannot lodge or germinate in it. Insects cannot feed upon it as they do upon wood.

Steel furnishing, in fact, meets the demands of modern life, and is in thorough harmony with modern progress; cool, refined and useful in a Fifth Avenue library in summer, and safe and useful before a roasting stove on a mountain side in winter; sensible, sane and sanitary, meeting all conditions and protecting valuable papers and books, under all circumstances, from fire and pilferers.



One of the many details of the Woolworth Building photographed by B. G. Mitchell, Architectural Photographer, 207 West One Hundred and Sixth St., New York City, who supplied most of the photographs illustrating this book.

INDEX

"Pridemark"